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Polypsecadium apolobamba (Brassicaceae), a New Species from Bolivia

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Abstract. *Polypsecadium apolobamba* Al-Shehbaz & A. Fuentes (Brassicaceae), a new species from Bolivia, is described and illustrated. It is readily distinguished from the other Bolivian species *P. harmsianum* (Muschler) O. E. Schulz by having uniseriate seeds, pilose leaves, and longer fruits, and from *P. rusbyi* (Britton) Al-Shehbaz by having shorter non-torulose fruits, smaller petals, and shorter and curved fruiting pedicels.

Key words: Bolivia, Brassicaceae, IUCN Red List, *Polypsecadium*, *Sisymbrium*.

Schulz (1924) established *Polypsecadium* O. E. Schulz (Brassicaceae) as a monotypic genus based on a species originally described by Muschler (1908) as *Thelypodium harmsianum* Muschler. The genus remained monotypic until Romanczuk and Boelcke (1982) added two new species from Argentina. Appel and Al-Shehbaz (2003) maintained the genus with three species, but, as recently shown by Bailey et al. (2007), one of those species (*P. burkartii* Romanczuk & Boelcke) belongs to *Exhalimolobos* Al-Shehbaz & C. D. Bailey.

Polypsecadium shows remarkable morphological similarities to several South American species previously assigned to *Sisymbrium* L. sensu Schulz (1924), Romanczuk (1982), and many others (see Al-Shehbaz, 2006). However, as shown by Warwick et al. (2002, 2006), *Sisymbrium* is not represented in South America by any native species, and all such *Sisymbrium* species belong to other genera of the tribe Schizopetaleae (as Thelypodieae). Indeed, Al-Shehbaz et al. (2006) placed *Sisymbrium* in the tribe Sisymbrieae and maintained the Schizopetaleae as a distinct but related tribe. These extensive studies prompted Al-Shehbaz (2006) to transfer all of the native South American species previously assigned in *Sisymbrium* to other genera, including *Polypsecadium*. As delimited by Al-Shehbaz (2006), *Polypsecadium* consists of 14 species restricted to South America and distributed from Colombia southward into Patagonia.

Recent fieldwork in Bolivia by one of us (AFF), as part of the "Floristic Inventory of the Madidi Region Project," led to the discovery of a new species of *Polypsecadium*. This novelty is described and illustrated below and brings the total in the genus to 15 species.

Polypsecadium apolobamba Al-Shehbaz & A. Fuentes, sp. nov. TYPE: Bolivia. La Paz: Prov. Franz Tamayo, ANMI [Area Natural de Manejo Integrado] Apolobamba, Piara hacia Pelechuco, bosque de yungas montano superior pluvial transicionando a ceja de monte, 2700–2900 m, 14°47′48″S, 69°00′52″W, 17 Apr. 2006, *A. Fuentes, M. Mendoza, M. C. Lopez & R. Roque 10076* (holotype, MO; isotypes, LPB, MO). Figure 1.

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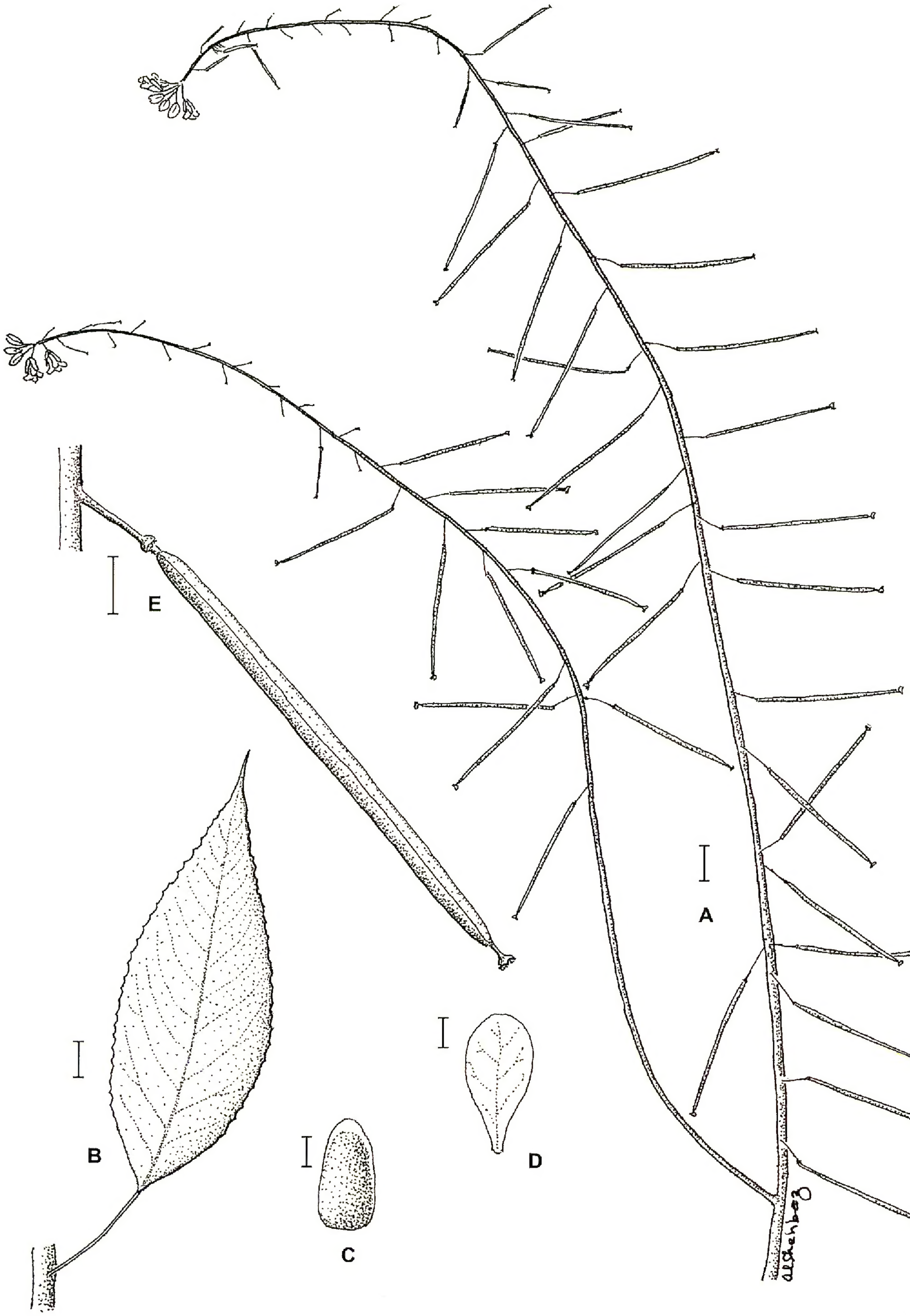

Figure 1. *Polypsecadium apolobamba* Al-Shehbaz & A. Fuentes. —A. Portion of fruiting raceme. —B. Middle cauline leaf. —C. Sepal. —D. Petal. —E. Fruit and fruiting pedicel. Scale bars: A, B = 1 cm; C, D = 1 mm; E = 5 mm. Drawn from the holotype, *Fuentes et al. 10076* (MO).

Herba ca. 1.6 m alta; folia caulina mediana late lanceolata, 10–13 × 3.5–4.5 cm, denticulata, acuminata, parce pilosa; racemi ebracteati; pedicelli fructiferi reflexi vel horizontales, 7–10 mm longi, glabri, recti, crassi; sepala oblonga, 3.5–4 × 1.2–1.6 mm, glabra; petala alba, obovata, 4–5 × 1.7–2 mm; ovula 66 ad 80. Fructus anguste lineares, 4–5.5 cm × 1.2–1.8 mm, glabri, recti; stylus 1–2 mm longus; stigma capitata; semina oblonga, uniseriata, 1–1.3 × 0.5–0.6 mm; cotyledones incumbentes.

Herbs ca. 1.6 m tall; glabrous except for leaves; stems erect, glabrous, several branched above. Cauline leaves petiolate, middle ones with petioles 2–4 cm, blade broadly lanceolate, 10–13 × 3.5–4.5 cm, sparsely pilose with simple trichomes 0.2–0.4 mm long, base cuneate, margin denticulate, apex acuminate; upper cauline leaves narrowly lanceolate to linear-lanceolate, gradually reduced in size and width upward, moderately to sparsely pilose. Racemes ebracteate, lax, elongated considerably in fruit; rachis straight, striate; fruiting pedicels reflexed or horizontal, 7–10 mm, straight, stout, glabrous. Sepals greenish pink, oblong, 3.5–4 × 1.2–1.6 mm, glabrous, membranous at margin, not saccate at base; petals white, obovate, 4–5 × 1.7–2 mm, not or obscurely clawed, only slightly longer than sepals; filaments white, median pairs 3–4 mm, lateral pair 2–2.5 mm; anthers oblong, 1–1.2 mm; ovules 66 to 80 per ovary. Fruits narrowly linear, 4–5.5 cm × 1.2–1.8 mm, not torulose, straight; valves with a distinct midvein, glabrous; gynophore ca. 0.5 mm; style 1–2 mm; stigma capitate, considerably wider than style. Seeds yellow, oblong, uniseriate, 1–1.3 × 0.5–0.6 mm; cotyledons incumbent.

Distribution and habitat. *Polypsecadium apolobamba* grows along roadsides in the pluvial montane yungas forests of the Apolobamba Mountain Range, together with species of *Weinmannia* L. (*W. pinnata* L.), *Hedyosmum* Swartz (*H. angustifolium* (Ruíz & Pavon) Solms), *Clethra* L., and *Ocotea* Aublet.

IUCN Red List category. *Polypsecadium apolobamba*, which is known thus far only from the type locality, appears to be extremely rare and restricted to the eastern slopes of the Apolobamba Range. Its distribution elsewhere in that range and in Bolivia is unknown, and, therefore, its IUCN conservation status remains uncertain.

Etymology. The species epithet "*apolobamba*," named after the Bolivian Apolobamba Mountain Range, is a noun used in apposition and, therefore, to be maintained according to Article 23.5 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006).

Relationships. *Polypsecadium apolobamba* is easily distinguished from *P. harmsianum* (Muschler) O. E. Schulz (Argentina [Jujuy, Salta, Tucumán], Bolivia [Chuquisaca, La Paz, Tarija]; Al-Shehbaz, 2006) by having pilose (vs. glabrous) leaves, uniseriate (vs. biseriate) seeds, and fruits 4–5.5 (vs. 1–2) cm long. From *P. rusbyi* (Britton) Al-Shehbaz (Bolivia [La Paz], Peru [Cuzco]; Al-Shehbaz, 2006), the new species differs by having obovate petals 4–5 mm long (vs. oblanceolate petals 7–8 mm long), straight and smooth fruits 4–5.5 cm long (vs. curved and torulose fruits [4.5–]5.5–8.5 cm long), and stout and straight fruiting pedicels 7–10 mm long (vs. slender and strongly curved pedicels 10–18 mm long).

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Innovations in *Hibiscus* and *Kosteletzkya* (Malvaceae, Hibisceae)

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Abstract. The combinations *Hibiscus moscheutos* L. subsp. *lasiocarpos* (Cavanilles) O. J. Blanchard, *H. clypeatus* L. subsp. *cryptocarpos* (A. Richard) O. J. Blanchard, and *H. clypeatus* subsp. *membranaceus* (Cavanilles) O. J. Blanchard are validated for a central North American plant taxon, a Cuban plant taxon, and a Bahamian plant taxon, respectively. The name *H. grandiflorus* Michaux is lectotypified. A new name, *Kosteletzkya semota* O. J. Blanchard, is established for the West African *K. stellata* Hutchinson & Dalziel, a later homonym. The neotype of the Philippine endemic *K. batacensis* (Blanco) Fernández-Villar is changed. Two well-known species, *K. virginica* (L.) C. Presl ex A. Gray of eastern North America and *K. pentacarpos* (L.) Ledebour of Eurasia, are synonymized under the latter name.

Key words: Hibisceae, *Hibiscus*, *Kosteletzkya*, Malvaceae, North America, Philippines, West Africa, West Indies.

My recent work on the Malvaceae for the *Flora of Tropical East Africa* (*Kosteletzkya*) and the *Flora of North America* (*Kosteletzkya* and *Hibiscus*), along with questions that have arisen in relation to recent work on the Malvaceae for the *Flora de la República de Cuba* by Fabiola Areces Berazaín and Paul Fryxell, have brought to light a number of nomenclatural matters that need attention. These include proposed validations of three subspecies, a lectotypification, a revised neotypification, and a replacement name for a later homonym. New synonymies for two species of *Hibiscus* L. and one of *Kosteletzkya* C. Presl are recorded, and an earlier name for a Bahamian taxon in *Hibiscus* is indicated.

Hibiscus sect. *Muenchhusia*

Hibiscus sect. *Muenchhusia* (Heister ex Fabricius) O. J. Blanchard comprises five species (Blanchard, 1976, 1988), all of which are large herbaceous perennials of North American wetlands. The variability of one of these species, now called *H. moscheutos* L., has given rise to more than a dozen species names over the years, but most of them have been subsequently reduced to synonymy. More recently, only two species have been recognized within what is now *H. moscheutos*: *H. moscheutos* L. s. str. in the eastern United States and *H. lasiocarpos* Cavanilles in the central part of the country, but the evidence suggests that even these two are better treated as subspecies of a single widespread and variable *H. moscheutos* (Blanchard, 1976). This new status has been recognized in some recent works (e.g., Browne & Athey, 1992; Chester et al., 1997; Jones et al., 1997; Yatskievych, 2000; Small, 2004), but the western subspecies remains to be validated.

1. Hibiscus moscheutos subsp. **lasiocarpos** (Cavanilles) O. J. Blanchard, comb. nov. Basionym: *Hibiscus lasiocarpos* Cavanilles, Diss. 3: 159, t. 70, f. 1. 1787. TYPE: s. loc., s.d., s. coll. (lectotype, designated by P. Fryxell, 1988: 211, P-JU 12390, IDC microfiche 917; isotype, MA, photo 15754 at BH).

In the typical subspecies, the capsules are glabrous and dark brownish black, the bracts of the involucel usually lack cilia, and the upper leaf surface is usually glabrous; in *Hibiscus moscheutos* subsp. *lasiocarpos*, the capsules are variously pubescent so that the dark surface is more or less obscured, the bracts of the involucel are usually ciliate, and the upper leaf surfaces are usually pubescent.

The eastern, glabrous-fruited *Hibiscus moscheutos* subsp. *moscheutos* is distributed from New Hampshire to Florida and westward, where it gives way to the more western, pubescent-fruited subspecies *lasiocarpos* in a narrow zone that extends from southern Illinois and Indiana to coastal Mississippi and Alabama. The latter subspecies extends further westward to southeastern Kansas, central Oklahoma, and southwestern Texas and also occurs disjunctly and sparingly in southern New Mexico, northern Mexico (Chihuahua), central California, and northern Florida. In Florida it often has been erroneously called *H. incanus* J. C. Wendland or *H. moscheutos* subsp. *incanus* (J. C. Wendland) H. E. Ahles. The name *H. incanus* in fact applies to a glabrous-fruited plant, and it is here identified as a synonym of *H. moscheutos* subsp. *moscheutos*. Wendland (1798: 54) originally described the fruit of *H. incanus* as "gross, dick, fünftheilig, *schwarz*" (italics mine), and his later illustration, showing a dark and apparently hairless

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capsule (Wendland, 1801: fig. 25), supports this interpretation. As there is no known specimen that might serve as type of *H. incanus*, the above figure, which matches the description well, is here designated as the lectotype.

Four additional species make up the remainder of *Hibiscus* sect. *Muenchhusia*. These are *H. laevis* Allioni of the eastern and central United States; *H. grandiflorus* Michaux and *H. coccineus* Walter of Florida and the adjacent coastal plain; and *H. dasycalyx* S. F. Blake & Shiller, an eastern Texas endemic of debated status (cf. Klips, 1995; Small, 2004). *Hibiscus grandiflorus* is based on material collected by A. Michaux, but the name has not been lectotypified previously. There are three specimens in the Michaux Herbarium at P (cf. IDC microfiche, fiche no. 84), and others (isotypes) at P (general herbarium), one of which I have seen and annotated, but I am designating here the following specimen from among the three in the Michaux Herbarium as the lectotype: that specimen bearing a flowering branch on the left, a separate large cauline leaf on the right, and a separate sterile branch with leaves below.

2. Hibiscus grandiflorus Michaux, Fl. Bor.-Amer. 2: 46. 1803. TYPE: "In maritimis Georgiae et Floridae et in regione Natchez ad Mississippi," s.d., *Michaux s.n.* (lectotype, designated here, P; isotypes, P).

Hibiscus grandiflorus is also known from Cuba from a single collection (*E. L. Ekman 11176*, S) that forms the basis for the later name *H. urbanii* Helwig, now recognized as a synonym of *H. grandiflorus*. To my knowledge the plant has not been re-collected in Cuba, so Ekman may have documented a transitory population.

Hibiscus sect. *Clypeati*

Hibiscus sect. *Clypeati* O. J. Blanchard (1988) comprises elements from Mexico, Guatemala, and the Caribbean islands that share the following characteristics: shrubby or arborescent habit; short-petaled zygomorphic flowers with dull-colored (dull orange to dull purplish brown) petals, calyces enlarging to enclose the bristly-hairy fruits, and glabrous, mottled seeds; and a preference for calcareous substrates. While several species have been described that would fall within this section, they all intergrade to a greater or lesser extent. The geographic variation within the one species recognized here, *H. clypeatus* L., seems best expressed by distinguishing three subspecies, thereby requiring the following two new combinations:

1. Hibiscus clypeatus L., Syst. Nat., ed. 10, 1149. 1759. TYPE: T. 160, f. 2 of J. Burman, Pl. Amer. fasc. 7, 1758.

The drawing that forms the basis for figure 2 was made by Plumier in the late 1600s in Haiti (Urban, 1920).

1a. Hibiscus clypeatus subsp. **clypeatus**

1b. Hibiscus clypeatus subsp. **cryptocarpos** (A. Richard) O. J. Blanchard, comb. nov. Basionym: *Hibiscus cryptocarpos* A. Richard, Hist. Phys. Cuba, Pl. Vasc. 1: 142. 1841 [1845]. *Abelmoschus cryptocarpos* (A. Richard) Walpers, Rep. Bot. Syst. 1: 310. 1842. TYPE: Cuba. *R. de la Sagra 881* (holotype, P not seen; isotype, P).

This subspecies is known only from Cuba.

1c. Hibiscus clypeatus subsp. **membranaceus** (Cavanilles) O. J. Blanchard, comb. nov. Basionym: *Hibiscus membranaceus* Cavanilles, Diss. 3: 159, t. 57, f. 2. 1787. TYPE: s. loc., s.d., s. coll. (holotype, P-JU not seen, IDC microfiche, fiche 915, spec. 12357).

Hibiscus brittonianus Kearney, Leafl. W. Bot. 7: 121. 1954. Syn. nov. Replaced name: *Hibiscus bahamensis* Britton, Bull. New York Bot. Gard. 4: 120. 1905, non *Hibiscus bahamensis* Miller, 1768. TYPE: Bahamas. Abaco: California Rd., 3 Jan. 1905, *L. J. K. Brace 2042* (lectotype, designated here, NY 84169; isotypes, F, K, NY, US).

Hibiscus clypeatus subsp. *membranaceus* is confined to the Bahamas and Caicos Islands and Île de la Tortue, Haiti. The plant has generally been known as *H. brittonianus* Kearney (1954). Cavanilles' *H. membranaceus* has remained until now an unapplied name because of the misleading reference to membranes on the calyx and the fact that its provenance is unknown. While the leaves of the type specimen are less deeply lobed than average, the plant is clearly of the same taxon as *H. brittonianus*. Even if this taxon is maintained as a species, the name *H. membranaceus* predates *H. brittonianus* by over a century and a half, and is the one that must be adopted. It is to draw attention to this fact that the Cavanillesian epithet is chosen here over that of Kearney.

One of the few botanists known to have visited the Bahamas before the appearance of Cavanilles' work was Mark Catesby, and it is a specimen of his, from the British Museum, that most closely conforms to the type material. There is no way of knowing whether Catesby was the source of the Cavanilles type in the Jussieu Herbarium (P-JU), but, if he was, the specimen may have arrived there through Sloane via Sherard (cf. Urban, 1902; Stafleu, 1964; Stafleu & Cowan, 1976).

Kosteletzkya semota

The African *Kosteletzkya stellata* Hutchinson & Dalziel is a later homonym and requires a new name.

Kosteletzkya semota O. J. Blanchard, nom. nov. Replaced name: *Kosteletzkya stellata* Hutchinson & Dalziel, Fl. W. Trop. Afr. 1(2): 270. 1928, non *Kosteletzkya stellata* Fernald, 1895. TYPE: Ghana. "Gold Coast," Anum, Nov. 1900, *W. H. Johnson 816* (lectotype, designated here, K).

It is evident that Hutchinson and Dalziel had intended that their new name be published in the *Bulletin of Miscellaneous Information* (1928), but part two of the first volume of the *Flora of West Tropical Africa* appeared first, in July 1928 (Stafleu & Cowan, 1979), more than a month before the 10 September publication date of the *Bulletin*. The authors cited several specimens (syntypes) in the earlier flora, but in the later *Bulletin* they explicitly identified one of these, *W. H. Johnson 816*, as type. The intent of the authors is preserved in the choice made here of a lectotype. The remaining syntypes are *A. Chevalier 22965* (K), *H. Millen 44* (K), and *H. Millen 53* (K).

Kosteletzkya semota is known only from the southern parts of Ghana, Benin, and Nigeria (Hepper, 1958) at low elevations. The name "semota" (Latin, *semotus*, meaning "far removed") refers both to the morphological distance of the plant from other members of the genus (it has an indurate capsule and sub-divaricate branching habit, both unique in the genus) and to its geographical restriction to the Dahomey Gap region, an area that is straddled, but not occupied, by the other three species that have West African distributions, i.e., *K. adoensis* (Hochstetter ex A. Richard) Masters, *K. buettneri* Gürke, and *K. grantii* (Masters) Garcke.

The name *Kosteletzkya stellata* Fernald (1895: 532) is based on a W. G. Wright collection (*1241*) from Mexico, from "Mazatlan and vicinity" (DS, F, G, GH, MO, UC, US; see Fryxell [1988: 247] for lectotypification with the GH specimen). A syntype is *F. H. Lamb 374*, from Isla Piedra, Mazatlán (DS, G, GH, MO, NY, US). The name is generally treated as a synonym (e.g., Robyns, 1966; Adams, 1972; Fryxell, 1988) of the widespread and variable northern Neotropical *K. depressa* (L.) O. J. Blanchard, Fryxell & D. M. Bates [= *K. pentasperma* Grisebach].

Kosteletzkya batacensis

A second name in the genus, *Kosteletzkya batacensis* (Blanco) Fernández-Villar, was earlier neotypified with a specimen that I interpret as being "in serious conflict with the protologue" (Greuter et al., 2000: Art. 9.16, Art. 9.17). A superseding neotype is proposed here.

Kosteletzkya batacensis (Blanco) Fernández-Villar, Nov. App. 24. 1880. Basionym: *Hibiscus batacensis* Blanco, Fl. Filip. 544. 1837. TYPE: Philippines. Luzon: Pampanga Prov., Apalit, Jan. 1923, *M. Ramos, Bureau of Science 41647* (neotype, designated here, US 1262055; isotypes, BM, G, K, L, P, UC, W).

Hibiscus batacensis Blanco was published in 1837 for a plant from Batac, Luzon, Philippines. The name was transferred to *Kosteletzkya* by Fernández-Villar in 1880, but the plant remained unknown for 70 years after it was described, until it was rediscovered by E. A. Mearns (*2215*, K) in 1907 (Merrill, 1909). Since then a few additional collections have been made, all from the island of Luzon (cf. Merrill, 1923; Borssum-Waalkes, 1966a).

No Blanco specimen is known to exist, but the original description matches the Philippine endemic *Kosteletzkya* well, so there is little doubt concerning the application of Blanco's name. Much later, when Borssum-Waalkes treated this species in his "Malesian Malvaceae revised" (1966b), he described and illustrated the plant in further detail, but at the same time he also neotypified the name, and, in so doing, he chose a sterile specimen of an entirely different species, *Modiola caroliniana* (L.) G. Don (Malvaceae, Malveae).

This choice of a neotype would seem at first glance inexplicable. The features of *Modiola* Moench depart considerably from the original description of *Hibiscus batacensis*. *Modiola* possesses three involucellar bracts versus seven to 10 in the latter, 16 to 22 ovary locules versus five in the latter, and two seeds per locule versus one in the latter (Fryxell, 1997). Yet Borssum-Waalkes (1966b: 87) declared that the neotype "matches Blanco's description very well." The explanation for this choice is probably twofold. First, Borssum-Waalkes may have been so strongly influenced by E. D. Merrill's earlier work on Blanco's names that he allowed himself to overlook some seemingly obvious differences; and second, his chosen specimens, being sterile, are lacking in the diagnostic reproductive features noted above and do indeed show some superficial resemblance vegetatively to the endemic *Kosteletzkya*.

The details behind the unusual sterile specimens are these. In the early 1900s Merrill had amassed and distributed several sets of Philippine specimens that he judged to represent the entities that Blanco had originally described as new. Then in 1918 Merrill published *Species Blancoanae: A Critical Revision of the Philippine Species of Plants Described by Blanco*

and by Llanos, based largely on these new collections. The collections themselves were distributed with simple labels that said only "Merrill, Species Blancoanae" followed by an identification number (in the case of the superseded neotype, "No. 877"). Merrill (1923: 41) himself expressed some doubt about his *Species Blancoanae 877* specimen, saying of its identification as *Kosteletzkya batacensis* "(probably, specimen sterile)." The data sheets attached to his duplicate at US explain the sterile gathering. "In December [1914] specimens were located in a vacant lot near the Philippine General Hospital and to guard against possible accidents [clearing of the lot or inability to find other material for 15 sets] sterile specimens were collected: up to the present time (January 1915) the plants have not flowered, and most of them have been destroyed in levelling the ground" (Nicolson, pers. comm.; cf. Nicolson & Arculus, 2001). Interestingly, Borssum-Waalkes did not report *Modiola caroliniana* from the Philippines in "Malesian Malvaceae revised" but only from Mt. Tengger in East Java.

If Borssum-Waalkes' neotypification (1966b) is allowed to stand, it will result in the relegation of *Kosteletzkya batacensis* and its basionym to synonymy under *Modiola caroliniana* and will necessitate the creation of a new name for the endemic Philippine *Kosteletzkya*. Also, if the original neotypification stands, it would be advisable to choose a different neotype from among the isoneotypes—specifically the one at US, where the first *Species Blancoanae* set and accompanying extensive label information are kept (Nicolson & Arculus, 2001).

The *Species Blancoanae 877* neotype (Borssum-Waalkes, 1966b) is in serious conflict with the description, not so much because the reproductive features of *Modiola* differ dramatically from those of *Kosteletzkya*, but because the specimen completely lacks such features, whereas the bulk of the original description of *K. batacensis* relates to flowers and fruits. It might be argued that the absence of something is not, strictly speaking, a conflict, but I contend that the spirit of Article 9.17 (Greuter et al., 2000)—the need to correct poorly made choices when they are obvious—certainly applies here.

Both Merrill and Borssum-Waalkes suspected that the Philippine *Kosteletzkya* was an introduction from the New World via the early-established trade route between the Philippines and Mexico, and both workers had communicated with Kew to ask that their *Kosteletzkya* holdings be searched for corresponding New World material (Merrill, 1909, 1912, 1918; Borssum-Waalkes, 1966b). Skepticism about an endemic Philippine (Luzonian) *Kosteletzkya* was eminently appropriate; the other 16 species in the genus are evenly divided between centers in Mexico and in tropical Africa. However, I have examined in excess of 3000 specimens of this genus from 32 herbaria and can confirm that the Luzon endemic is indeed that.

Specimens of the superseded neotype (*E. D. Merrill Species Blancoanae 877*) are known from BO, GH, L, MO, P, and US.

Kosteletzkya virginica and *K. pentacarpos*

A final innovation in *Kosteletzkya* involves two Linnaean species. In the first edition of *Species Plantarum* (1753), Linnaeus described within *Hibiscus* two species that are now placed in *Kosteletzkya*. One of these, *K. virginica* (L.) C. Presl ex A. Gray, is a familiar plant of North American coastal marshes from New York to the coastal bend of Texas. It also occurs in Cuba and Bermuda. The second species, *K. pentacarpos* (L.) Ledebour, is a rare Eurasian plant (Pino et al., 2007) known from a few widely scattered localities in Spain, Corsica, Italy, Iran, Azerbaijan, Georgia, and Russia.

Although *Kosteletzkya virginica* is a variable taxon, its northeastern-most representatives (e.g., those in New Jersey) differ in no significant way from the Eurasian plants, and so I am treating the two as a single species. According to the *International Code of Botanical Nomenclature* (Greuter et al., 2000: Art. 11.5), when two simultaneously published taxa are subsequently united, the correct name is the one chosen by the person who first unites them. Cavanilles (1787: 145) was the first to merge the two taxa, under the epithet *pentacarpos*. As a consequence, the North American plants must now be known as *K. pentacarpos*, and *K. virginica* must be relegated to synonymy. In *Kosteletzkya* the epithet has sometimes been given as "pentacarpa" to agree with the feminine generic noun (e.g., Riedl, 1976: 28; Nogueira & Paiva, 1993: 193; Czerepanov, 1995: 314), but Linnaeus capitalized the epithet, thereby indicating that it is to be treated as a generic noun in apposition. It is thus correct to retain the original Greek masculine ending.

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Impatiens rupestris (Balsaminaceae), a New Species from Hunan, China

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ABSTRACT. *Impatiens rupestris* K. M. Liu & X. Z. Cai, a new species of Balsaminaceae from Hunan Province in southern China, is described and illustrated. An identification key to the new species and its relatives is provided. *Impatiens rupestris* differs from *I. polyneura* K. M. Liu in its lamina base widely cuneate or ± rounded, the lateral veins in 11 to 16 pairs, the dorsal petal widely obovate, and the lower lobes of the lateral united petals connate into obovate lamella. It is distinct from *I. obesa* Hooker f. in its lamina elliptic or ovate-oblong, lateral united petals stipitate, upper corolla lobes widely obovate or suborbicular, lower corolla lobes connate into obovate lamella, and seeds with tuberculate testa.

Key words: Balsaminaceae, China, Hunan, *Impatiens*, IUCN Red List.

Impatiens L. (Balsaminaceae) is one of the largest genera in the world and consists of over 900 species mainly distributed in the highlands and mountains of the Old World tropics, and also in parts of temperate Asia and Europe (Grey-Wilson, 1980a, b; Chen, 2001; Fischer, 2004; Stevens, 2004). There are about 240 species recorded in China and most are endemic (Chen, 2001; Jin & Ding, 2002; Huang et al., 2003). The genus is characterized by the unusual androecium partially fused around the ovary, usually having a nectary-tipped spur, the four lateral petals connate in pairs, and the 4- or 5-valved, loculicidal capsule, from which the seeds are often explosively dispersed.

In a recent scientific survey of *Impatiens* in southern Hunan for the *Flora of China*, an interesting species was collected in Jiangyong County. On further visits to the same locality, additional material was gathered to provide a range of specimens with flowers and mature fruits. After comparison with morphologically similar taxa and study of publications for China and neighboring countries (Shimizu, 2000; Chen, 2001; Jin & Ding, 2002; Huang et al., 2003), we conclude that the specimens represent an undescribed species.

Impatiens rupestris K. M. Liu & X. Z. Cai, sp. nov. TYPE: China. Hunan: Jiangyong Co., 350 m, 111°9′59.7″E, 25°6′11.8″N, limestone crevices on S slopes, 22 July 2006, *K. M. Liu & X. Z. Cai 772938* (holotype, HNNU; isotypes, MO, HNNU). Figure 1.

Species *Impatienti polyneurae* K. M. Liu affinis, sed laminis foliorum basi vulgo late cuneatis vel suborbiculatis, nervis lateralibus 11- ad 16-jugis, petalo dorsali late obovato, petalis lateralibus inferioribus connatis facile differt. Ab *I. obesa* Hooker f. laminis foliorum ellipticis vel ovato-oblongis, petalis lateralibus stipitatis, lobis corollae superioribus late obovatis vel suborbiculatis, inferioribus connatis obovatis apice emarginato, seminibus parvi-tuberculatis facile differt.

Succulent herb, 25–60 cm tall, glabrous; stems erect, thick, to 1.2 cm diam., simple or rarely branched from middle, leafless proximally, yellow-green, with purple-red spots and numerous adventitious roots. Leaves alternate, distally crowded; petiole 1–4 cm, with purple-red spots; lamina membranous, elliptic or ovate-oblong, apex acuminate, 6–13.5 × 3–6 cm, margin serrulate, teeth mucronulate, base widely cuneate or ± rounded, with 2 ovoid sessile glands at base, primary lateral veins in 11 to 16 pairs, curved, conspicuous abaxially and adaxially, abaxial midvein purple-red spotted. Flowers solitary, rarely 2-flowered; peduncles very short, ca. 1 mm; pedicels 2–2.5 cm, ca. 1.2 mm diam. when fresh, glabrous, usually purple-red spotted, bracteate at base; bracts lanceolate, ca. 1.5 mm, membranous, persistent. Flower pale purple, 2.5–3 cm; lateral sepals 4, outer 2 obliquely ovate or suborbicular, thick, 8–12 mm, the midvein conspicuous, margin entire, apex mucronulate; inner 2 sepals minute, narrowly lanceolate or linear, ca. 2 mm; lower saccate sepal broadly funnel-shaped, dorsal ventral light green, usually with red-yellow striations along the vascular bundle, sometimes the colors lighten, 20–25 mm from pedicel to base of spur; mouth slightly ascending, ca. 11 mm wide, anterior mucronulate; base abruptly constricted into an incurved, 2-lobed short spur; dorsal petal widely obovate, to 1.5 × 1.2–1.5 cm, base cuneate, apex retuse, abaxial midvein thickened, cristate, apex rostellate; lateral united petals stipitate, 2-lobed, ca. 1.8–2.2 cm; upper lobes widely obovate or suborbicular, ca. 8 mm wide; lower corolla lobes connate into obovate lamella, apex emarginate, sometimes with erose purple spots or absent; abaxial auricle reflexed, triangular, orange; filaments linear, 2–3 mm, upper part dilated; anthers ovoid, joined into a ring

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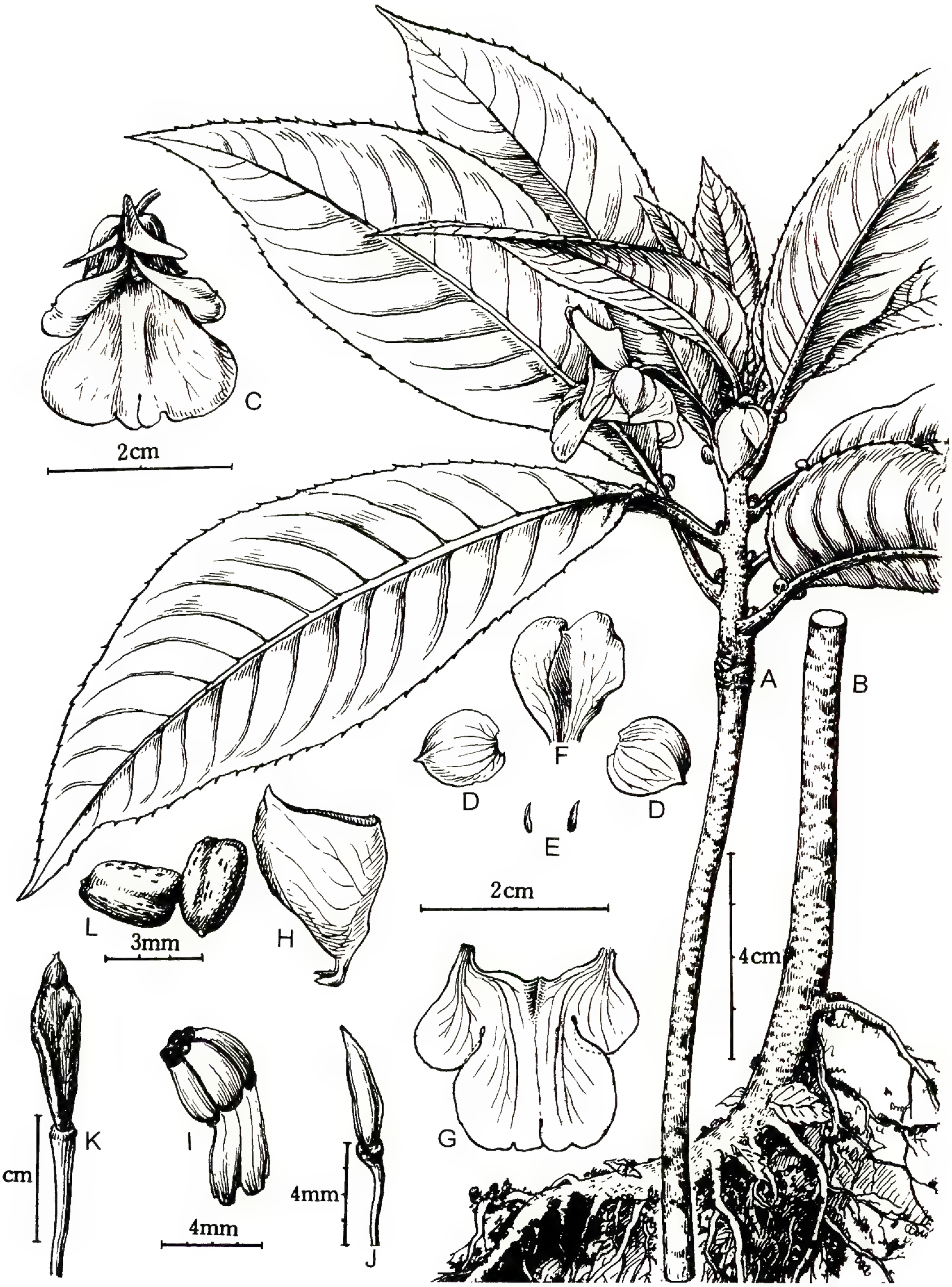

Figure 1. *Impatiens rupestris* K. M. Liu & X. Z. Cai. —A. Upper portion of flowering stem. —B. Lower part of the stem and adventitious roots. —C. Flower, front view. —D. Outer two lateral sepals. —E. Inner two lateral sepals. —F. Dorsal petal. —G. Lateral united petals, dorsal view. —H. Lower sepal. —I. Androecium, showing poricidal dehiscence. —J. Ovary. —K. Fruit. —L. Seeds. Drawn by L. H. Liu from the holotype, *K. M. Liu & X. Z. Cai 772938* (HNNU).

surrounding the ovary apex, apex obtuse, with poricidal dehiscence; ovary fusiform, 4-carpellate, apex curved-rostellate, ca. 4 mm. Capsule rhombic-fusiform, 10–13 mm, 4-angled, rostellate; seeds 4 or 5, oblong, ca. 3 × 2 mm, brown, testa tuberculate.

Distribution and habitat. *Impatiens rupestris* is known only from Jiangyong County, Hunan, China, in stony crevices on slopes of limestone areas. Here it grows at an altitude of 350 m, in association with *Paliurus hemsleyanus* Rehder, *Zanthoxylum echinocarpum* Hemsley, *Pterolobium punctatum* Hemsley, *Glochidion puberum* (L.) Hutchinson, *Alyxia sinensis* Champion ex Bentham, *Urena lobata* L., *Belamcanda chinensis* (L.) DC., and *Ophiopogon japonicus* (L. f.) Ker Gawler.

IUCN Red List category. *Impatiens rupestris* is currently known only from Jiangyong County, Hunan, and the overall plant population there is small, consisting of about 1200 individuals. The number of mature individuals is about 800. As such, it should be considered Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001). Additional ecological and biological study should be taken toward effective conservation measures.

Phenology. The plants flower from July to September and fruit from August to October.

Taxonomic remarks. Y. L. Chen (2001) considered short peduncles, pedicels bracteate at the base, and lower lobes of lateral united petals connate or adnate into broad lamella as original characters in *Impatiens*, such as *I. obesa*, *I. morsei* Hooker f., *I. hainanensis* Y. L. Chen, *I. polyneura*, and *I. musyana* Hooker f. Compared with species of *Impatiens* with four lateral sepals, *I. rupestris* closely resembles *I. polyneura* in its stipitate lateral united petals, emarginate apex, and tuberculate seed testa. It differs from *I. polyneura* by its widely cuneate or ± rounded lamina base, the lateral veins in 11 to 16 pairs, the widely obovate dorsal petal, and the lower corolla lobes connate into obovate lamella. Although *I. rupestris* is similar to *I. obesa* in the pedicels that are bracteate at the base and persistent, and the minute inner two sepals (ca. 2 mm), *I. obesa* differs mainly in its ovate or oblanceolate leaves, cuneate lamina base, sessile lateral united petals, pyriform upper corolla lobes, dolabriform lower corolla lobes, and glabrous seeds. The new species and similar species of *Impatiens* in China may be distinguished through the following key.

Key to *Impatiens rupestris* and Similar Species with Four Lateral Sepals in China

1a. Inflorescences without peduncles; pedicels without bracts . . . . . *I. musyana*

1b. Inflorescences with short peduncles; pedicels with bracts at base, bracts persistent.
  2a. Lateral united petals sessile, lower corolla lobes dolabriform, apex rounded-obtuse; seeds glabrous . . . . . *I. obesa*
  2b. Lateral united petals stipitate, lower corolla lobes connate into orbicular or obovate lamella, apex emarginate; seed testa tuberculate.
    3a. Lamina base cuneate; primary lateral veins in 16 to 21 pairs; dorsal petal obovate-oblong; lower corolla lobes connate into orbicular lamella . . . . *I. polyneura*
    3b. Lamina base widely cuneate or ± rounded; primary lateral veins in 11 to 16 pairs; dorsal petal widely obovate; lower corolla lobes connate into obovate lamella. . . . . *I. rupestris*

Paratype. CHINA. **Hunan Prov.:** Jiangyong, *K. M. Liu & X. Z. Cai 777488* (HNNU).

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A New Species in *Lophiaris* (Orchidaceae, Oncidiinae), in the *Lophiaris straminea* Complex

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ABSTRACT. An undescribed species of *Lophiaris* Rafinesque (Orchidaceae, Cymbidieae, Oncidiinae) was detected while conducting a phylogenetic study of *Trichocentrum* Poeppig & Endlicher s.l. *Lophiaris sierracaracolensis* Cetzal & Balam is described from Sierra Caracol in the Central Depression of Chiapas, on the Pacific slopes of Mexico. The new species is illustrated, and its affinities are discussed. The novelty is related to *L. straminea* (Bateman ex Lindley) Braem, but the labellum isthmus is broader (to 3 mm wide), the claw of the dorsal sepal is very short (1.5 mm long) and wide, and the callus is 8-partite (vs. 5-partite in *L. straminea*).

Key words: Chiapas, IUCN Red List, *Lophiaris*, Mexico, Oncidiinae, Orchidaceae.

During phylogenetic study of the *Trichocentrum* Poeppig & Endlicher s.l. complex (Balam et al., in prep.; Carnevali et al., in prep.; Cetzal et al., in prep.), a hitherto unknown taxon referable to the genus *Lophiaris* Rafinesque was detected. This new entity is closely related and geographically intermediate between two other members of the genus, *L. aurisasinora* (Standley & L. O. Williams) Braem and *L. straminea* (Bateman ex Lindley) Braem. The first species is known from Honduras and Nicaragua, while the second is restricted to a small area of calcareous hills in central Veracruz, Mexico. These two taxa are characterized by small vegetative plants (as compared to other Mesoamerican members of *Lophiaris* with mature leaves 7–15 cm long) and white, greenish to straw-colored flowers borne on proportionally short inflorescences. The novelty here proposed, *L. sierracaracolensis* Cetzal & Balam, is similar to these two species but is a conspicuously larger plant. The three species will be referred to hereafter as the *L. straminea* complex. These three species are also distinctive in growing at intermediate elevations of 700–1200 m; most *Lophiaris* species grow at elevations below 500 m and a group of mainly Mexican species of the genus related to *L. cavendishiana* (Bateman) Braem usually grow above 2000 m. Besides the conspicuous vegetative differences, the flowers of the new species have a broader isthmus of the labellum, proportionally broader basal lobes (reniform, about as long as wide vs. oblong, longer than wide), and a more complex callus. Comparisons of the three species are featured in Table 1.

As opposed to other authors (e.g., Chase et al., 2005; Pupulin, 1995; Sandoval-Zapotitla & Terrazas, 2001; Sosa et al., 2001; Williams et al., 2001a, b) that treat all the members of the *Trichocentrum* complex as a single genus (*Trichocentrum* Poeppig & Endlicher), we have chosen to describe this new taxon in the genus *Lophiaris*. The rationale behind this narrower generic circumscription is discussed elsewhere (Carnevali et al., 2001; Jiménez-Machorro & Carnevali, 2001; Pupulín & Carnevali, 2005) and basically relies on the logic of recognizing more easily diagnosable genera rather than larger, polymorphic, morphologically impossible to define generic units. These narrower generic limits within the *Trichocentrum* complex have been used in several recent publications (e.g., Braem, 1993; Königer, 1997, 1999; Romero & Carnevali, 2000; Pupulín & Carnevali, 2005; Balam, 2007). *Lophiaris* is well supported as a monophyletic clade by nucleotide sequence data (e.g., Sosa et al., 2001; Carnevali et al., in prep.). In addition, within the *Trichocentrum* complex, the taxon is clearly marked by a suite of morphological characters including conduplicate leaves on top of reduced pseudobulbs, elongate, flexuous inflorescences, sepals and petals with reticulate venation, and a papillose outer surface of the perianth (Balam, 2007). The anther bed is deltate in *Lophiaris* as opposed to elliptic, ovate, or elliptic-ovate in other members of the *Trichocentrum* complex. The stigmatic surface in *Lophiaris* flowers is obtriangular to obovate as opposed to elliptic or deltoid in the other members of the *Trichocentrum* complex (Balam, 2007).

Lophiaris sierracaracolensis Cetzal & Balam, sp. nov. TYPE: Mexico. Chiapas: Mun. Villaflores, Sierra El Caracol, 10 km al O del

Table 1. Morphological comparison of the *Lophiaris straminea* species complex.

	L. straminea	*L. aurisasinora*	*L. sierracaracolensis*
Plants	small (ca. 20 cm)	small (20–25 cm)	larger (30–38 cm)
Inflorescence	short (15–30 cm)	short (10–15 cm)	long (> 50 cm)
Dorsal sepal claw	short and broad	long and narrow	long and narrow
Petal claw	short and broad	long and narrow	shortly clawed
Lateral lobes of the labellum	oblong, rounded, much surpassing the spread margins of the apical lobe	triangular, acute to obtuse, narrower than the spread margins of the apical lobe	broadly reniform, rounded at apex, about as broad as the spread margins of the apical lobe
Labellum isthmus	short and narrow	long and narrow	short and broad
Marginal thickenings of labellum isthmus	absent or like 2 small plates	present and conspicuous	present and conspicuous
Labellar callus	5-partite: a pair of basal teeth, perpendicular to the main axis of labellum, a distal pair of smaller, round teeth, and a central keel-like unit that is placed on the isthmus	3-partite: a pair of basal teeth and a central keel entering the isthmus	8-partite: a small pair of proximal teeth almost perpendicular to main labellum axis, a larger pair of porrect teeth, and a central keel that is apically 3-toothed
Column wings	long, narrow, pointing toward the base of the column	short, broad, and divaricate	short, broad, and divaricate

ejido La Sombra de la Selva, ca. 14°19′00″N, 93°37′00″W, ca. 860 m, selva baja caducifolia, 17 July 1995, *M. A. Pérez Farrera 565* (holotype, Herbario Eizi Matuda; isotypes, CICY, MO [holotype fragm.]). Figure 1C–F.

Species haec *Lophiari aurisasinorae* (Standley & L. O. Williams) Braem similis, sed planta majore, foliis 37–39 cm longis non 20–25 cm longis, floris minoribus, labello 8.5–10 mm longo non labello 15 mm longo, unguiculo sepalino dorsali ca. 1.5 × 1.5 mm, isthmo latiore, callo 8-dentato (non 3-dentato) abhorret. Verisimiliter *L. stramineae* (Bateman ex Lindley) Braem affinis, sed isthmo multo latiore, callo 8-dentato (non 5-dentato) recedit.

Epiphytic herb to 38 cm tall (not including the inflorescence); roots 0.5–2.5 mm thick; pseudobulbs clustered, subcylindrical, ca. 1.9 × 1.5 cm, slightly flattened laterally, apically 1-leaved. Leaves 37–39 × 7.6–8 cm, elliptic, acute, erect, thickly coriaceous, dorsally keeled. Inflorescences borne on the base of the mature pseudobulb, one per pseudobulb, racemose, apparently erect-arching, the peduncle apparently elongate (broken and apparently incomplete in the type specimen). Flowers resupinate, ca.

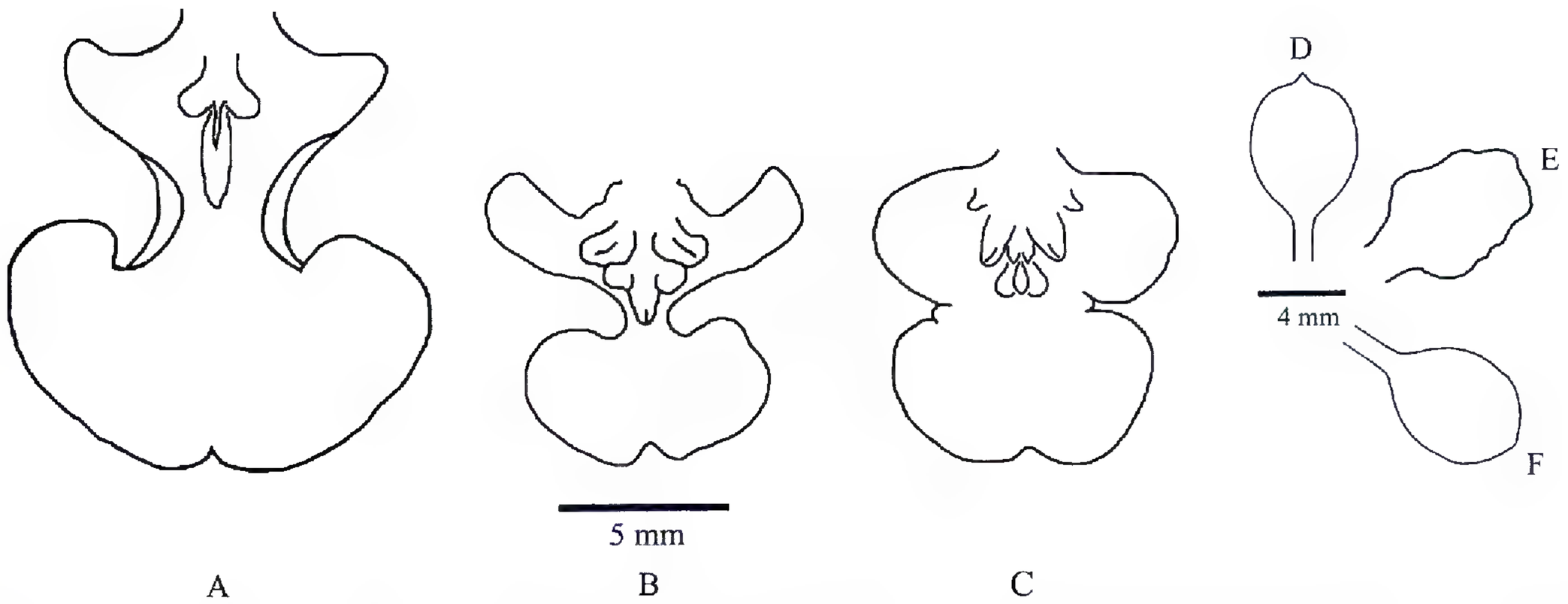

Figure 1. A–C. Labella of members of the *Lophiaris straminea* complex. —A. *L. aurisasinora* (Standley & L. O. Williams) Braem, based on *A. Molina 1823* (US). —B. *L. straminea* (Bateman ex Lindley) Braem, based on *Carnevali 7161* (CICY). —C. *L. sierracaracolensis* Cetzal & Balam. D–F. Floral parts of *L. sierracaracolensis*. —D. Dorsal sepal. —E. Petal. —F. Lateral sepal. Based on *Pérez Farrera 565* (Herbario Eizi Matuda).

18 mm diam.; dorsal sepal 7–8 × 3–4.2 mm, 5-nerved, obovate to suborbicular, concave, obtuse, clawed, claw ca. 1.5 × 1.5 mm; lateral sepals 7–8 × 3 mm, obovate to elliptic, obtuse, 5-nerved, clawed, the claw ca. 2 × 1–1.5 mm; petals ca. 6 × 5–5.5 mm, shortly clawed, claw ca. 0.5 mm long, blade oblong-ovate, obtuse, 7-nerved; labellum ca. 8.5–10 × 7 mm, 3-lobed, pandurate, the lateral lobes reniform, ca. 2.5 × 3 mm, ca. 8 mm across their spread apices; central lobe transversely reniform, 7–7.5 × 3.5 mm, apically emarginate, isthmus ca. 0.5 × 2–3 mm, short and broad; callus 4–5 × 3 mm, placed at labellum base, barely reaching the isthmus, made up of 8 units: a small pair of proximal teeth almost perpendicular to main labellum axis; a larger pair of porrect teeth, and a central keel that is apically 3-toothed; column ca. 4 × 2 mm, proportionally short, thick, with divergent, thick wings that are flattened at their basalmost 2/3 and thickened at the apical 1/3, the base with a rounded lobe; anther ca. 2 × 1.5 mm, ovoid with a truncate apex, bilocular; pollinarium ca. 2 mm, composed of 2 obovoid pollinia, elongated, stipe short-laminar and viscidium horseshoe-shaped; stigmatic cavity deltoid, flat. Capsule unknown.

Distribution, habitat, and IUCN Red List category. *Lophiaris sierracaracolensis* is known from a single collection, gathered in the forests of the Central Depression in Chiapas at an elevation of 860 m. The lone specimen comes from an ecosystem described by the collector as "selva baja caducifolia" ("tropical deciduous forest"). The Central Depression of Chiapas is ca. 200 km long and up to 70 km wide and is characterized by a seasonally dry climate (in some places, of less than 800 mm annual rainfall), and has been characterized by Contreras (cited in Breedlove, 1981) as semi-arid and referred to as Tropical Deciduous Forest. It is completely surrounded by moist, densely forested mountain areas, affording it complete isolation from other pockets of xeric vegetation, and supports an interesting flora characterized by a large number of endemics (Breedlove, 1981). However, the tropical deciduous forest in the Central Depression is being displaced by heavy cultivation and grazing and is being quickly replaced by large tracts of thorn woodland and savanna. Thus, the single type of habitat the species is known from is being severely threatened. Furthermore, the species is known from a single collection, suggesting that it may be rare. Hence, the species might be considered VU (Vulnerable) or EN (Endangered) according to IUCN criteria (IUCN, 2001). However, since we have not been to the type locality, and considering the possibility that the species may be locally common, we prefer to assess its conservation status as DD (Data Deficient).

Etymology. The new species is named after Sierra Caracol, a small mountain range in the Central Depression of Chiapas, where the type specimen was collected.

Relationships. This new taxon is similar to *Lophiaris aurisasinora* but is easily distinguished by the larger plants (with leaves to 37–39 cm long vs. 25 cm long in *L. aurisasinora*), the isthmus of the labellum much broader, the callus more complex, and the flowers much smaller (with labellum ca. 8.5–10 mm long vs. up to 15 mm in *L. aurisasinora*). *Lophiaris straminea*, from central Veracruz, is geographically nearer and of about the same floral size, but *L. sierracaracolensis* is distinguished by the labellum with a much wider isthmus (to 3 mm wide vs. 2 mm) and a different callus that consists of eight teeth (vs. callus with five teeth in *L. straminea*). While the two other members of the *L. straminea* complex feature flowers that are white, greenish, or straw-colored, the flowers of *L. sierracaracolensis* are described as "amarillas, rojas y blancas" on the holotype label. This new species is poorly known, and more material is required to ascertain vegetative variability, inflorescence shape and attitude, and the actual flower color and appearance when fresh. Floral tracings of the three members of the *L. straminea* complex are displayed in Figure 1.

We offer the following key for the identification of the three known members of this complex, the *Lophiaris straminea* complex:

KEY TO THE *LOPHIARIS STRAMINEA* COMPLEX

1a. Lip with long isthmus (4–5 mm); labellum ca. 15 mm long; plants from Honduras and Nicaragua . . . . . *L. aurisasinora*

1b. Lip with a very short isthmus (0.5–2 mm); labellum not exceeding 10 mm long; plants from Mexico 2

2a. Plants vegetatively small (pseudobulbs + leaves rarely exceeding 25 cm tall); claw of the dorsal sepal very short and wide (0.5 mm long); claw of the labellum central lobe 1–2 mm long; endemic to Veracruz . . . . . *L. straminea*

2b. Plants larger (pseudobulbs + leaves exceeding 30 cm tall); claw of the dorsal sepal long and thin (1.5 mm long); claw of the labellum central lobe 4–5 mm long; endemic to Chiapas. . . *L. sierracaracolensis*

Acknowledgments. We are indebted to the curators of the many herbaria that loaned us material for our work with the *Trichocentrum* s.l. complex: AMES, AMO, B, BM, CIQR, F, K, Herbario Eizi Matuda, MEXU, MO, NY, US, VEN, XAL. Gustavo A. Romero-González, curator of AMES, helped us with

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A New Species of Alkali Grass (*Puccinellia*, Poaceae) from the Western North American Arctic

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ABSTRACT. A new species of alkali grass, *Puccinellia banksiensis* Consaul from Banks Island, Northwest Territories, in the Canadian Arctic, is described and illustrated. This diploid species is most similar to the Russian and Alaskan tetraploid *P. hauptiana* (Trinius ex V. I. Krecznetowicz) Kitagawa, from which it differs by having dense panicles with erect branches and palea keels with curly hairs in the proximal half; to the Siberian species *P. neglecta* (Tzvelev) Bubnova, which is larger with less dense inflorescences and wider leaves; and to the circumpolar hexaploid *P. angustata* (R. Br.) E. L. Rand & Redfield, from which it differs by having smaller spikelets and florets. It differs from other *Puccinellia* Parlatore species on Banks Island and the northern coast of Alaska by having lemmas shorter than 2.7 mm with scabrous apical margins and anthers shorter than 0.9 mm. Although morphology suggests a close relationship with *P. angustata*, *P. hauptiana*, and *P. neglecta*, genetic evidence suggests it is a distinct species. It is local and rare, and grows in low-elevation, *Dryas* L.–dominated tundra beside coastal lakes.

Key words: Arctic, IUCN Red List, Poaceae, *Puccinellia*.

During an expedition to Banks Island, Northwest Territories, Canada, in 2003, we collected specimens that differed from other Arctic *Puccinellia* Parlatore species in Aiken et al. (2003) and Tzvelev (1964, 1983) by having more erect panicle branches and smaller spikelets. These plants were growing within several kilometers of the coast, near the shores of inland freshwater lakes. The new specimens were not morphologically similar to any of the other *Puccinellia* species growing in the vicinity, *P. arctica* (Hooker) Fernald & Weatherby, *P. vahliana* (Liebmann) Scribner & Merrill, *P. angustata* (R. Brown) E. L. Rand & Redfield, and *P. andersonii* Swallen.

A single specimen in the National Herbarium of Canada (CAN) matched our new collections. This specimen, with a single small culm, had been collected in 1971 in an ecological survey of an area on Banks Island near Egg River, Northwest Territories, Canada, by Kaye MacInnes and John Lambert (Carleton University, Ottawa). It resembled a tiny depauperate *Puccinellia angustata* and had been annotated as such by S. G. Aiken in 1989 and by LLC in 2000. Subsequently, our attention was brought to a single similar specimen from Prudhoe Bay collected as "*P.* sp." by R. Elven and H. Grundt (s.n.) in 1998 and annotated as *P. angustata* by A. Batten in 2001. Examination of the additional and more complete specimens that we collected in 2003 suggested that these annotations were incorrect.

Chromosome counts (Consaul et al., in press) revealed that the Banks Island specimens of the new species are diploid, not hexaploid like plants of *Puccinellia angustata* (Löve & Löve, 1975; Consaul, unpublished data). We included the diploid specimens of this new species from Banks Island in an investigation of the taxonomic limits of all diploid *Puccinellia* species in the North American Arctic using morphological measurements from field vouchers and common garden experiment vouchers, amplified fragment length polymorphism (AFLP) data, and DNA content from flow cytometry (Consaul et al., in press). From this investigation we concluded that six diploid taxa should be recognized in the Canadian

Arctic: *P. arctica* (including *P. agrostidea* T. J. Sørensen and *P. poacea* T. J. Sørensen), *P. tenella* (Lange) Holmberg ex Porsild subsp. *langeana* (Berlin) Tzvelev, *P. alaskana* Scribner & Merrill, *P. vahliana*, *P. wrightii* (Scribner & Merrill) Tzvelev, and a new species represented by our Banks Island specimens. This new species is distinct from the other diploid species by having much smaller spikelets and florets, a significantly lower amount of DNA per nucleus, and a distinct pattern of AFLP markers (Consaul et al., in press). Its morphological characteristics suggest it belongs in the section *Puccinellia* (Tzvelev, 1983; Ovchinnikova, 1989), series *Orientales* S. V. Ovchinnikova (Ovchinnikova, 1989), being similar to *P. hauptiana* (Trinius ex V. I. Krecznetowicz) Kitagawa and *P. neglecta* (Tzvelev) Bubnova of this group (Bubnova, 1990). In this paper we describe the new species, compare it to sympatric *Puccinellia* species, and compare it to circumpolar *P. angustata*, Beringian *P. hauptiana*, and Siberian *P. neglecta*, which closely resemble it.

Puccinellia banksiensis Consaul, sp. nov. TYPE: Canada. Northwest Territories: Banks Island, S shore of unnamed lake 2.5 km S of Masik River, 71°35.638′N, 123°08.937′W, 19 July 2003, *L. L. Consaul 2810, L. J. Gillespie & H. Bickerton* (holotype, CAN; isotypes, ALA, MO, MTMG, O). Figure 1.

Herba perennis, caespitosa, non stolonifera; caules floriferi 5–20 cm alti, erecti vel decumbentes. Paniculae 2–8 cm longae; rami erecti; pedicelli scabrelli. Flosculi 2 ad 4(5); gluma prima 0.8–1.8 mm longa, gluma secunda 1.3–2.0 mm longa; lemma 1.7–2.3(–2.7) mm longum, in dimidio inferiore moderate villosum; carinae paleae ad apicem ciliatae, in dimidio inferiore pilis crispis praeditae. *Puccinelliae hauptianae* (Trinius ex V. I. Krecznetowicz) Kitagawa affinis, sed paniculis densis carinis palearum in dimidio inferiore villosis differt. A *P. neglecta* (Tzvelev) Bubnova paniculis, ramis, lemmate et palea brevioribus differt. A *P. angustata* (R. Brown) E. L. Rand & Redfield lemmate et palea brevioribus differt. A *P. arctica* (Hooker) Fernald & Weatherby lemmate 1.7–2.3(–2.7) mm longo, palea 1.5–2.3 mm longa, carinis paleae in dimidio inferiore villosis, antheris 0.4–0.8 mm longis differt.

Perennial herb, caespitose, lacking stolons; flowering culms 5–20 cm tall, erect or decumbent. Ligules membranaceous, ovate-oblong or transversely oblong, 0.5–2.0 mm; basal leaf blades usually involute, rarely flat, 4–8 × 0.7–1.2 mm when flattened; flag leaf 0.5–1.2 cm, arising above the midpoint of the culm. Panicles 2–8 cm, lowest primary branch 0.6–4.0 cm with spikelets beginning 0.3–3.0 cm from proximal end; lowest panicle internode 0.5–2.6 cm; branches usually erect, occasionally slightly ascending; pedicels scabrous, 0.1–0.3 mm wide. Spikelets 2.2–5.0 mm, with 2 to 4(5) florets; glumes unequal; first glume ovate, 0.8–1.8 × 0.4–0.8 mm; second glume ovate, occasionally elliptic, 1.3–2.0 × 0.5–1.2 mm, apical margin minutely scabrous; lemmas greenish, frequently tinged with purple, often with a yellowish band near the margin, 1.7–2.3(–2.7) × 0.8–1.0 mm, apex acute or obtuse, occasionally truncate, apical margin minutely scabrous, abaxial surface moderately hairy to 1.5 mm from the base; callus with a ring of hairs 0.1–0.2 mm long; paleae 1.5–2.3 × 0.3–0.6 mm, keels with short straight hairs distally and curly hairs proximally extending from just below halfway point to almost the base; rachilla between first and second lemmas 0.5–1.5 × 0.5–0.12 mm; anthers 3, 0.4–0.8 mm. $2n = 14$.

Distribution, habitat, and conservation status. *Puccinellia banksiensis* is known only from three localities on southern Banks Island, Northwest Territories, Canada, and one locality in northern Alaska, U.S.A. It was collected on Banks Island in Arctic tundra 20–30 m above sea level. The species has been found infrequently, in localized populations of up to about 100 individuals, in frost-heaved, turfy tundra, with *Dryas integrifolia* Vahl, *Cassiope tetragona* (L.) D. Don, *Astragalus alpinus* L., and *Arnica angustifolia* Vahl. This species grows in a habitat that is more densely vegetated than that of the other *Puccinellia* species found nearby. This species should be sought in other Low Arctic, *Dryas*-dominated tundra habitats on Victoria Island, on the adjacent Canadian mainland, and in the Beringian region. *Puccinellia banksiensis* should be considered critically imperiled (ranks S1, N1, G1) according to Nature Conservancy rankings (The Nature Conservancy, 1988). Considering the criteria of the IUCN Red List (IUCN, 2001), this species qualifies for VU (Vulnerable) status by having a population of less than 1000 individuals, without any knowledge of the potential changes in the size of habitat or populations. However, if climate change continues to warm the habitats along the coastal areas of the southwestern Arctic, this species may attain the rank of EN (Endangered), as it has less than 2500 individuals at no more than five locations and a projected decline in quality of habitat. This is a possible threat because this species is diploid, and diploid species have been shown to have a narrower tolerance to variation in habitats than polyploid species (Levin, 1983).

Etymology. This species is named after the type locality, Banks Island, Northwest Territories, Canada.

Affinities. *Puccinellia banksiensis* resembles three species more closely than any others in North America and Russia. The first is the tetraploid taxon *P. hauptiana* from far eastern Russia (Tzvelev, 1964, 1983) and far western Alaska (Bowden, 1961).

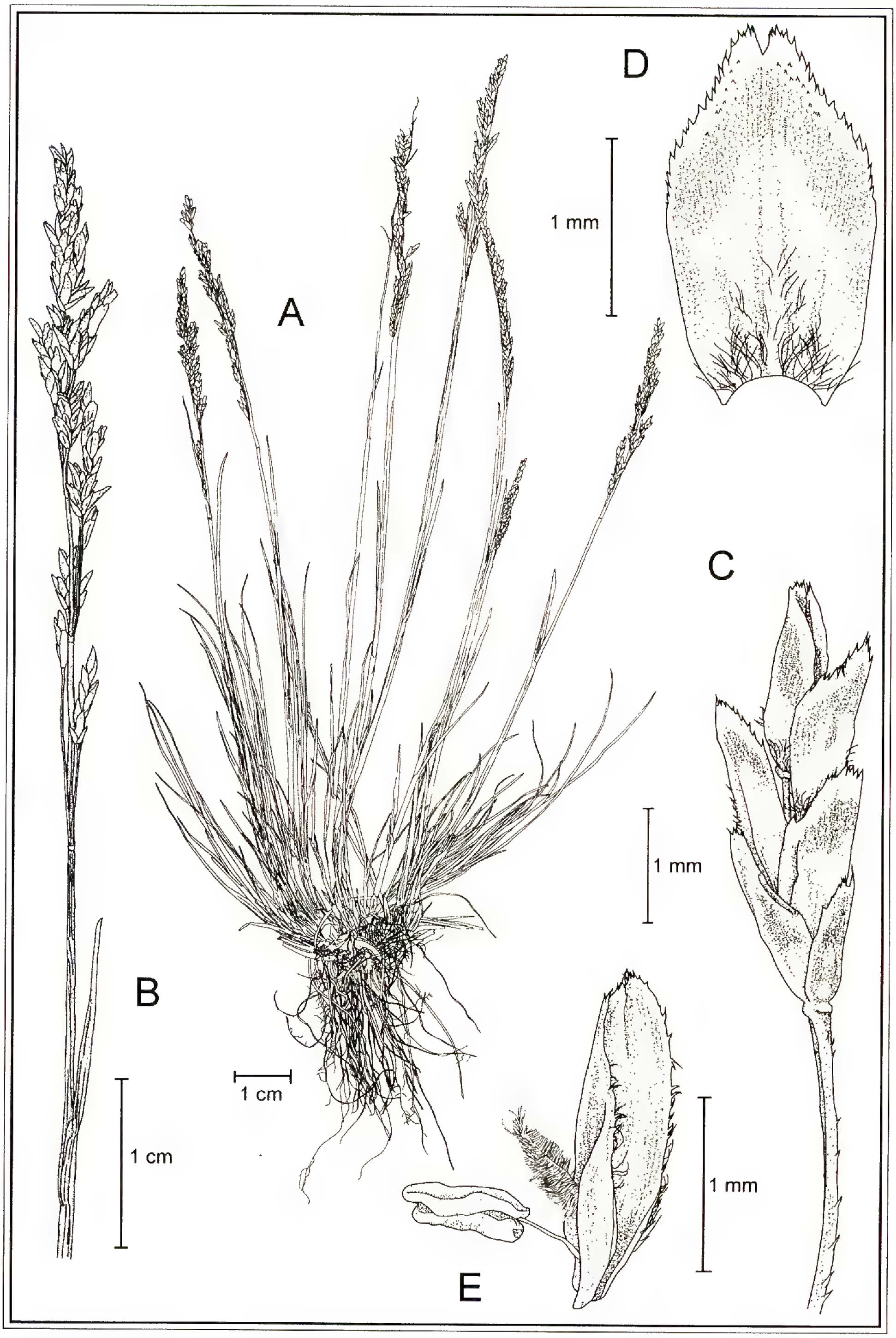

Figure 1. *Puccinellia banksiensis* Consaul. —A. Plant habit. —B. Single culm. —C. Single spikelet and subtending pedicel. —D. Lemma, abaxial view. —E. Palea, oblique abaxial view showing curly hairs on the two keels, stigma attached to top of ovary, and one of three anthers. Drawn from the holotype, *L. L. Consaul 2810, L. J. Gillespie & H. Bickerton* (CAN).

Morphologically, diploid *P. banksiensis* differs from *P. hauptiana* chiefly by having panicle branches that are almost always erect and palea keels that are spinulose in the distal portion with curly hairs in the proximal half near the base. The tetraploid, on the other hand, has ascending or horizontal branches and palea keels that lack curly hairs in the proximal half (Tzvelev, 1964). We compared the AFLP patterns of *P.*

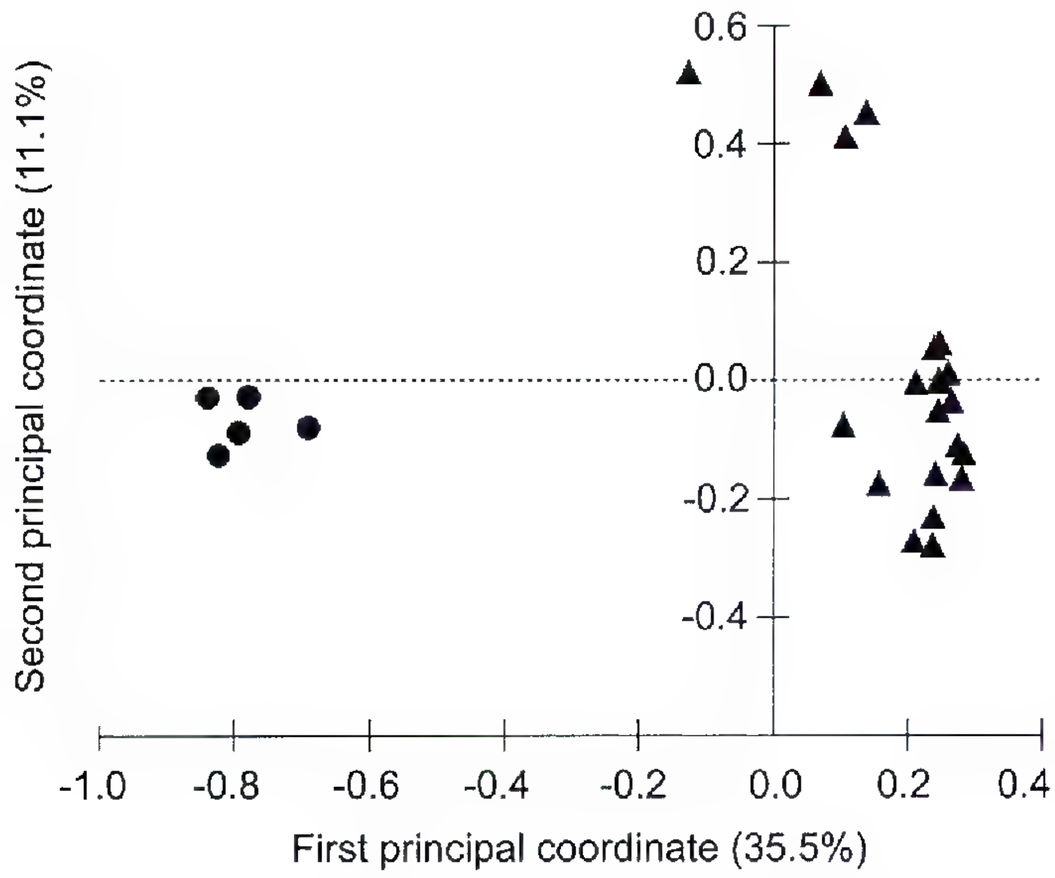

Figure 2. Principal coordinates ordination of AFLP presence/absence data. Triangles show *Puccinellia banksiensis* specimens and circles show *P. hauptiana* specimens.

banksiensis and *P. hauptiana* using the protocols cited in Consaul et al. (in press) and the specimens of *P. banksiensis* and *P. hauptiana* cited below. Figure 2 illustrates the clear distinction between these two taxa based on AFLP markers.

The second species that *Puccinellia banksiensis* closely resembles is the Siberian species *P. neglecta*, which is taller, with longer inflorescences that are compact and compressed or open with long erect to horizontal branches (vs. short erect branches in *P. banksiensis*), with leaves 1.5–2.0 mm wide (vs. 0.7–1.2 mm in *P. banksiensis*). The chromosome number of *P. neglecta* is unknown. *Puccinellia neglecta* was originally described as a subspecies of *P. borealis* Swallen, but with less hair on the branches and smaller anthers. The latter two species are currently included in *P. nuttalliana* (Schult.) Hitc. by North American authors (Davis & Soreng, 2003; Davis & Consaul, 2007), but the key characters below distinguish them in the Beringian region.

The third species that diploid *Puccinellia banksiensis* closely resembles is the circumpolar hexaploid *P. angustata*. *Puccinellia banksiensis* differs from *P. angustata* by having a denser tuft of basal leaves and smaller spikelets, glumes, and florets, the lemmas of *P. banksiensis* being no longer than 2.7 mm (vs. to 5.2 mm in *P. angustata*). *Puccinellia banksiensis* grows in closest geographical proximity to *P. angustata* and the diploid *P. arctica*. It differs from *P. arctica* by its narrow and contracted inflorescence, and having anthers 0.4–0.8 mm and curly hairs on the lower half of the palea keels (vs. often diffuse inflorescence, anthers 1.2–2.2 mm, and absence of curly hairs on the lower half of the palea keels in *P. arctica*). Other *Puccinellia* species growing nearby on southern Banks Island and the northern Alaskan coast are the diploids *P. tenella* subsp. *langeana*, *P. alaskana*, and *P. vahliana*, and the polyploid *P. andersonii*. The key below gives the main differences among these taxa.

DNA sequence comparisons of Arctic *Puccinellia* for internal and external transcribed spacer regions of the nuclear ribosomal genes (ITS and ETS1f) and the chloroplast *rpoB-trnC* intergenic spacer show that *P. banksiensis* forms its own clade with bootstrap support of 100% (Consaul et al., unpublished data). Therefore, despite similarities in morphology, genetic evidence suggests that diploid *P. banksiensis* is a distinct species that was not involved in the formation of the tetraploid *P. hauptiana* or the hexaploid *P. angustata*.

Key to *Puccinellia* Species on Banks Island, Canada, the Southwestern North American Arctic, and Closely Related Species in Siberia

1a. Pedicels smooth; lemma apical margins smooth or crenulate.
  2a. Lemmas 3–5 mm; palea keels scabrous distally, frequently with curly hairs on the lower portion; anthers 1.0–2.0 mm.
    3a. Culms 5–15 cm; panicles 2–4 cm, branches erect to slightly ascending . . . . . *P. vahliana*
    3b. Culms 15–40 cm; panicles 5–8 cm, branches usually ascending to horizontal . . . . . *P. wrightii*
  2b. Lemmas 2–3 mm; palea keels glabrous or slightly ciliate; anthers 0.5–0.9 mm.
    4a. Lemmas 2–2.5 mm, apices obtuse; glume and lemma margins smooth to crenulate; palea keels glabrous . . . . . *P. tenella* subsp. *langeana*
    4b. Lemmas 2.5–3.0 mm, apices acute; glume and lemma margins smooth but not crenulate; palea keels slightly ciliate . . . . . *P. alaskana*
1b. Pedicels slightly to densely scabrous; lemma apical margins scabrous, sometimes with only a few scabrules.
  5a. Lemmas (2.1–)2.3–5.2 mm; anthers 0.8–2.2 mm.
    6a. Anthers (0.9–)1.2–2.2 mm. . . . . *P. arctica*
    6b. Anthers 0.8–1.0 mm.
      7a. Palea keels glabrous in proximal half; lemma apical margin irregularly serrate or moderately to strongly erose . . . . . *P. andersonii*
      7b. Palea keels hairy in proximal half; lemma apical margin entire to slightly erose. . . . . *P. angustata*
  5b. Lemmas 1.5–2.3(–2.7) mm; anthers 0.3–0.8 mm.
    8a. Leaves 3–7 mm wide; palea keels shortly ciliate in proximal half; anthers 0.8–1.0 mm . . . . . *P. distans* (Jacquin) Parlatore

8b. Leaves < 3 mm wide; palea keels spinulose in upper half; at least some lemmas with curly hair in proximal half or glabrous but not shortly ciliate in lower half; anthers < 0.8 mm.
9a. Palea keels glabrous in proximal half; lemmas 1.5–1.8(1.9) mm . . . . . *P. hauptiana*
9b. Palea keels usually hairy (may be glabrous or with only a few long hairs) in proximal half; lemmas > 1.7 mm.
10a. Plants 50–80 cm tall; panicles 15–25 mm, diffuse, branches lax . . . . . *P. borealis*
10b. Plants < 50 cm tall; panicles < 10 cm, diffuse or dense, branches erect or lax.
11a. Plants 20–25 cm tall; leaves 1.5–2.0 mm wide; panicles 7–10 cm, dense, branches erect to lax; lemmas 2.3–2.5(3.0) mm . . . . . *P. neglecta*
11b. Plants 5–20 cm tall; leaves 0.7–1.2 mm wide; panicles 2–8 cm, slender, branches usually erect; lemmas 1.7–2.3 mm . . . . . *P. banksiensis*

Paratypes. CANADA. **Northwest Territories:** Banks Island, vic. of Egg River near jct. w/Big River, 72°25.65′N, 124°24.39′W, 28 July 2003, *L. L. Consaul 2842, L. J. Gillespie & H. Bickerton* (CAN, MTMG); DeSalis Bay, 1–2 km W of Windrum Lagoon, 71°28.186′N, 121°53.051′W, 21 July 2003, *L. L. Consaul 2814, L. J. Gillespie & H. Bickerton* (CAN, MTMG); Egg River, Area #16, 24 July 1971, *K. L. MacInnes s.n.* (CAN). U.S.A. **Alaska:** Arctic coast, Prudhoe Bay, E dock, 70°18–19′N, 148°18′W, 5 Aug. 1998, *R. Elven & H. H. Grundt s.n.* (ALA).

Puccinellia hauptiana—Specimens analyzed for AFLP patterns. RUSSIA. [**Northwestern Federal District:**] Leningrad, 1 July 1919, *Litwinow s.n.* (CAN); **Baj-Chaak District:** Tuva, 26 June 1986, *Bubnova s.n.* (CAN); **[Far Eastern Federal District]**: Yakutia, *Kogelnukov 109* (CAN). U.S.A. **Alaska:** Mile 73.8 from Valdez on Richardson Hwy., *Dutilly, Lepage & O'Neill 21,314* (CAN); Palmer, on RR ballast, *Dutilly, Lepage & O'Neill 20,115* (CAN).

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Magnolia vazquezii (Magnoliaceae), una Especie Nueva del Estado de Guerrero, México

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RESUMEN. Se describe *Magnolia vazquezii* Cruz Durán & K. Vega (Magnoliaceae), una especie nueva del Estado de Guerrero, México. Esta entidad taxonómica sólo se ha colectado en el bosque mesófilo de montaña del Estado de Guerrero y es afín a *M. schiedeana* Schlechtendal, pero difiere de esta última por presentar estípulas rojas, brácteas pubescentes, pedúnculo pubescente y más largo, pétalos de tamaño y forma diferente, gineceo oblongo y estigmas rectos. Se incluye una clave para distinguir las especies afines a este nuevo taxón, así como una ilustración del mismo.

ABSTRACT. *Magnolia vazquezii* Cruz Durán & K. Vega (Magnoliaceae) is described as a new species from the state of Guerrero, Mexico. It has been collected only in cloud forest in the state of Guerrero and appears similar to *M. schiedeana* Schlechtendal, but differs in its red stipules, pubescent bracts, pubescent and longer peduncles, longer and different-shaped petals, and an oblong gynoecium with erect stigmas. The new taxon is illustrated and a dichotomous key distinguishes it from related taxa.

Key words: Cloud forest, Guerrero, IUCN Red List, *Magnolia*, Magnoliaceae, Mexico.

En el estudio del género *Magnolia* L. (Magnoliaceae) para la flora de Guerrero, México, se han hallado dos especies que se distribuyen en la Sierra Madre del Sur, *M. krusei* J. Jiménez Ramírez & Cruz Durán, en bosques mesófilos a una altitud sobre el nivel del mar de 1800 m o menos y *M. vazquezii* Cruz Durán & K. Vega en la porción oriental (relativamente cercana a los límites con el estado de Oaxaca) en bosques mesófilos más fríos entre los 2150 y los 2341 m.s.m.

Magnolia vazquezii es parecida a *M. schiedeana* Schlechtendal, pues ambas tienen hojas parecidas en forma y tamaño, poseen flores pequeñas, pétalos gradualmente atenuados (característica que comparten con *M. poasana* (Pittier) Dandy de Costa Rica y Panamá, otra especie de la sección *Theorhodon* Spach a la que pertenecen las dos especies anteriormente mencionadas), además son las únicas especies de la sección *Theorhodon* con 48 o menos estambres y polifolículos glabros con un diámetro de 2.8 cm o menos, pero la especie nueva difiere de *M. schiedeana* por tener hojas pubescentes en el envés, pecíolos pubescentes, estípulas de color rojo intenso, pedúnculo pubescente, brácteas pubescentes más anchas, sépalos oblongos con el envés verde-grisáceo, pétalos oblongo-obovados con las series externa e interna de tamaño marcadamente diferente, gineceo oblongo y blanco o blanco-verdoso desde el botón, estigmas rectos o ligeramente curvos, desde botón hasta el fruto, polifolículo generalmente con un número menor de folículos y flor con aroma cítrico, aunque algunas veces se detecta un ligero aroma a flor de *Annona* L. (ver clave que se presenta al final de este trabajo).

A fin de conocer las diferencias entre las especies se efectuaron colectas y observaciones de algunos ejemplares vivos de *Magnolia schiedeana* en el Jardín Botánico Javier Clavijero del Instituto de Ecología A.C. y de ejemplares silvestres vistos en las cercanías de Xalapa, Veracruz, dado que el lectotipo, designado por Vázquez (1994), de *Schiede & Deppe 296* (P) fue colectado en una población cercana a esta ciudad. Esto permitió establecer que *M. schiedeana* tiene las

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hojas y pecíolos glabros, estípulas blancas o muy ligeramente rosadas (en ocasiones llegan a casi rojas, pero nunca de un rojo intenso [Vázquez-García, com. pers.]), pedúnculo glabro de (1–)1.5–1.7 cm de largo, brácteas glabras, sépalos oblongo-elípticos con el envés verde claro, pétalos obovados con las series externa e interna prácticamente del mismo tamaño, gineceo ovoide y de color verde claro, estigmas fuertemente recurvados desde botón y flor con aroma dulce como la miel, características que son diferentes a las descritas con anterioridad para *M. vazquezii*.

Estudios sobre los componentes químicos del aroma floral de Magnoliaceae (Azuma, 1999; Thien et al., 2000) han encontrado que cada especie tiene un perfil propio, por ejemplo, *Magnolia schiedeana* y *M. tamaulipana* A. Vázquez poseen predominantemente geranil metil éter en 80% y en 86% respectivamente y son polinizadas únicamente por dos especies de escarabajo, en cambio, el aroma floral de *M. grandiflora* L. contiene 75% de 15 monoterpenos (donde el geraniol es el principal componente con el 20%) y es polinizada por 11 especies de escarabajo (Azuma, 1999). Es obvia la relación entre los componentes del aroma floral y los polinizadores dentro del género, por ello no deja de ser importante señalar la diferencia de olor entre las flores de *M. vazquezii* y *M. schiedeana*.

Vázquez (1994) y Vázquez et al. (2002) afirman que las especies de *Magnolia* de la sección *Theorhodon* presentan un marcado patrón de especiación alopátrica, donde las distancias geográficas o ambientales son fundamentales para la separación de las poblaciones en especies diferentes. Tal circunstancia parece explicar nítidamente la separación geográfica entre *M. schiedeana* que habita en la porción sureña de la Sierra Madre Oriental y *M. vazquezii* que tiene distribución restringida a las porciones elevadas y húmedas del oriente de la Sierra Madre del Sur. Es fácil entender la separación espacial entre ambas especies, pues la cadena montañosa que comunica a las sierras mencionadas es el Eje Neovolcánico Transversal que no tiene, en la mayor parte de su extensión, las condiciones ecológicas adecuadas para la existencia de poblaciones de *Magnolia*, por lo que el aislamiento es completo en este momento. Y la Sierra de Taxco, un brazo del Eje Neovolcánico que se extiende al sur, atravesando las porciones secas de la Cuenca del Río Balsas, hasta casi tocar la porción central de la Sierra Madre del Sur, no cuenta entre su flora a ninguna especie de *Magnolia*.

La especie nueva presenta peculiaridades interesantes, en ocasiones sus flores están agrupadas en lugar de ser solitarias, la flor terminal es la más madura y las dos inferiores están en botón (algo semejante ha sido observado en muy rara vez en *Magnolia krusei*) o tienen cuatro sépalos en lugar de tres. En otras flores existen siete pétalos en lugar de seis, de manera parecida, en este último verticilo, a lo que describe Vázquez (1994) para *M. pacifica* A. Vázquez.

Magnolia vazquezii Cruz Durán & K. Vega, sp. nov. TIPO: México. Guerrero: Mpio. San Luis Acatlán, Km 73–74, carr. Tlapa–Marquelia, 17°07′24.3″N, 98°42′07.6″O, 2150 m, bosque mesófilo de montaña, 6 may. 2005 (fl), *J. Jiménez & K. Vega 1402* (holotipo, FCME; isotipos, MEXU, MO). Figura 1.

Magnoliae schiedeanae Schlechtendal affinis sed differt foliis pubescentibus, stipulis valde rubris 6–6.5 × 1.4 cm, bracteis extus pubescentibus; pedunculo pubescenti, 2.2–3 cm longo; sepalis 3 vel raro 4, oblongis, viridi-cinereis; petalis 6 vel 7, oblongis-obovatis, 3–5 × 1.3–1.7 cm; staminibus (34)36 ad 40(44); gynoecio (14)16- ad 24-carpellato, oblongo, albo-viridi, stigmate erecto vel leviter curvato; folliceto oblongo, ca. 5 × 2.5–2.8 cm; folliculo 2–2.4 cm longo, seminibus prismatico-triangularibus vel prismatico-subtriangularibus, 7–9 × 5–9 mm.

Árboles 14–18 m de alto, con ramificación a partir de los 2 m de altura; ramas verdosas a grises, con lenticelas blancas escasas; ramillas con pubescencia blanca. *Hojas* elípticas, pecíolo 1.5–2.3(–2.5 cm), terete, ligeramente acanalado, densamente pubescente; *lámina* (9.2–)10–17.7(–22) × 4.5–8 cm, elíptica, haz glabro, envés con abundante pubescencia blanca (con la edad se vuelve ferrugínea), en ocasiones el envés es ligeramente pubescente sólo en la vena media y las venas secundarias, ápice obtuso, base ligeramente cuneada; *estípulas* 6–6.5 × 1.4 cm, de color rojo intenso, ligeramente pubescentes hacia el ápice. *Flores* terminales o muy rara vez agrupadas en un dicasio (la flor central está más desarrollada que las dos inferiores), hasta 10 cm diám.; pedúnculos 2.2–3 cm, pubescentes; *brácteas* 2, ca. 2.7 × 3–3.4 cm, pubescentes externamente, pubescencia amarillo pálido; *sépalos* 3 o rara vez 4, 4.6–5 × 2–2.2 cm, oblongos, reflejos, envés verde-grisáceo, haz blanco; *pétalos externos* 3, 4–5 × 1.5–1.7 cm, oblongo-obovados; *pétalos internos* 3 o rara vez 4, ca. 3 × 1.3 cm, oblongo-obovados; *estambres* (34)36 a 40(44), 1–1.1 × 0.2 cm, el punto de unión entre el receptáculo y los estambres de color rojo obscuro (el resto del receptáculo blanco); *gineceo* (1.2–)1.6–2 × 0.5–1 cm, ovoide, blanco o blanco-verdoso, pubescencia blanca; *carpelos* (14)16 a 24, 0.9–1 cm, estigmas papilados, rectos o ligeramente curvos. *Polifolículo* ca. 5 × 2.5–2.8 cm, oblongo, verdoso cuando joven, glabro, (12)16 a 24 folículos; *folículo* 2–2.4 × 0.9–1 cm; *semillas* 7–9 × 5–9 mm, prismático triangulares a prismático subtriangulares, testa color rojo coral, frecuentemente 2 por folículo.

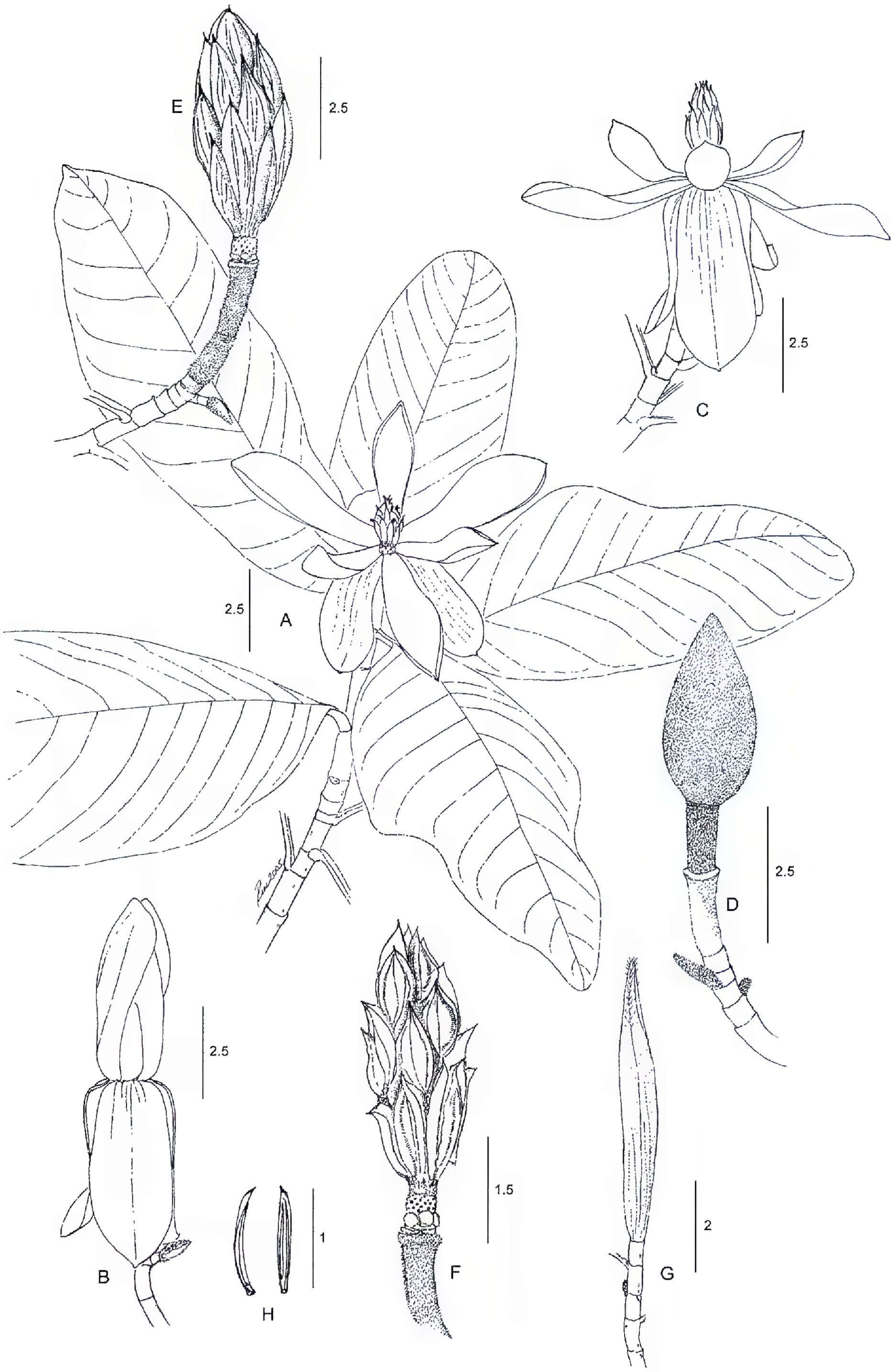

Figura 1. *Magnolia vazquezii* Cruz Durán & K. Vega. —A. Rama con flor. —B. Flor parcialmente en antesis. —C. Flor en antesis, vista lateral. —D. Botón floral. —E. Polifolículo inmaturo. —F. Polifolículo. —G. Estípula. —H. Estambre, vista lateral y ventral. A y H, *J. Jiménez & K. Vega 1402* (FCME, holotipo) y *1404* (FCME); B y D, *J. Jiménez & K. Vega 1401* (FCME); C, *J. Jiménez & K. Vega 1403* (FCME); E y F, *J. Jiménez & K. Vega 1400* (FCME) y *1402* (FCME, holotipo); G, *J. Jiménez & K. Vega 1402* (FCME, holotipo). Todas las barras en centrimetros. Ilustrado por Ramiro Cruz Durán.

Distribución y hábitat. Esta especie se conoce de los bosques mesófilos de montaña, en suelo profundo con hojarasca y asociada a *Clethra mexicana* DC. y *Oreopanax* Decaisne & Planchon. También se le ha encontrado en bosque de *Pinus* L. y *Quercus* L. En potreros derivados de bosque mesófilo de montaña es, con frecuencia, la única especie arbórea conservada (tal vez por el uso que le dan los habitantes de la zona). Prospera en altitudes de 2150–2342(–2430) m.

Conservación. La especie nueva se coloca tentativamente en la categoría EN (En Peligro) de la lista roja de la IUCN (2001), pues el hábitat está siendo destruido rápidamente (deforestación para cultivo o potrero). Se conocen aproximadamente 300 individuos maduros, no se han observado individuos jóvenes (no hay reclutamiento) y su área de distribución conocida es menor a 500 km^2.

Fenología. Florece y fructifica de marzo a mayo, aunque excepcionalmente se le encuentra en fructificación en noviembre.

Uso. Una infusión de la flor se utiliza contra afecciones del corazón (obs. pers.).

Nombre local. Ixé ridiin (tlapaneco). Nombre proporcionado por un campesino al colectar el ejemplar *J. Jiménez & K. Vega 1400* (FCME) y escrito por su hijo en caracteres fonéticos aprendidos en una escuela primaria bilingüe.

Etimología. El nombre de la especie es en honor a J. Antonio Vázquez-García, destacado especialista del género *Magnolia* en México y América Central.

Clave Para Diferenciar *Magnolia vazquezii* de *M. schiedeana* y *M. pacifica*

1a. Sépalos 2–3.5 cm de largo; pétalos externos anchamente obovados a suborbiculares, 2.5–5 cm de ancho, base abruptamente atenuada; androceo con (65)70 a 100(113) estambres. . . . . *M. pacifica*

1b Sépalos 4.6–5 cm de largo; pétalos externos obovados u oblongo-obovados, 1.5–2 cm de ancho, base gradualmente atenuada; androceo con (29)36 a 48 estambres.

2a. Hojas con envés glabro; pecíolos glabros; estípulas blancas a ligeramente rosadas o intensamente rosadas (casi rojo claro); brácteas glabras, 3.2 × 2.8 cm; pedúnculo glabro; sépalos oblongo-elípticos, envés verde claro; pétalos obovados, la serie interna y externa de tamaño similar, pétalos internos de 1.5–1.7 cm de ancho; gineceo ovoide, glabro y de color verde claro; estigmas muy curvados; polifolículo con 21 a 35 folículos; semillas 6–8 × 6–7 mm; flor con aroma dulce, como de miel . . . . . *M. schiedeana*

2b. Hojas con envés pubescente; pecíolos pubescentes; estípulas intensamente rojas; brácteas pubescentes, ca. 2.7 × 3–3.4 cm; pedúnculo pubescente; sépalos oblongos, envés verde-grisáceo; pétalos oblongo-obovados, la serie externa claramente más grande que la interna; pétalos internos de 1.3 cm de ancho; gineceo oblongo, pubescente y blanco o blanco-verdoso; estigmas rectos o muy ligeramente recurvados; polifolículo con (12)16 a 24 folículos; semillas 7–9 × 5–9 mm; flor con aroma a cítrico (en ocasiones recuerda ligeramente al aroma de flor de *Anonna*) . . . . . *M. vazquezii*

Paratipos. MÉXICO. **Guerrero:** Mpio. Malinaltepec, ladera N del Cerro Tlalpizahuac, a 200 m de la desviación Tlapa–Iliatenco, *E. Velázquez 102* (FCME); Cerro Santiago, *J. Jiménez & K. Vega 1400, 1401, 1404, 1635, 1636* y *1637* (FCME); Km 64, carr. Tlapa–Marquelia, adelante de la desviación a La Soledad, *J. Jiménez & K. Vega 1638* (FCME); Tres Marías, ca. 1.1 km al SE, *R. de Santiago & L. Lozada 1710* (FCME); Mpio. San Luis Acatlán, Km 73–74, carr. Tlapa–Marquelia, *J. Jiménez & K. Vega 1403* (FCME).

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Haematoxylum sousanum (Leguminosae, Caesalpinioideae), una Especie Nueva del Sur de México

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Resumen. Se describe e ilustra *Haematoxylum sousanum* Cruz Durán & J. Jiménez Ramírez, una especie nueva (Leguminosae, Caesalpinioideae) de la parte alta de la Cuenca del Río Balsas, al sur de México. Esta especie es afín a *H. brasiletto* H. Karsten, pero difiere por presentar hojas paripinnadas o biimparipinnadas, flores en inflorescencias paniculadas, partes florales de forma diferente, fruto falcado y diferente fenología.

Abstract. *Haematoxylum sousanum* Cruz Durán & J. Jiménez Ramírez, a new species (Leguminosae, Caesalpinioideae) from the high Balsas basin from southern Mexico, is described and illustrated. It appears similar to *H. brasiletto* H. Karsten, but differs in presenting paripinnate or bi-imparipinnate leaves, flowers in panicles, floral parts different in form, falcate fruits, and distinct phenology.

Key words: Caesalpinieae, Caesalpinioideae, Guerrero, *Haematoxylum*, IUCN Red List, Leguminosae, Mexico, Oaxaca, Puebla.

El género *Haematoxylum* L. pertenece, según Polhill y Vidal (1981) y Lewis (2005), a la tribu Caesalpinieae, grupo Caesalpinia. En estudios moleculares recientes, el grupo mantiene su monofilia (Haston et al., 2005), sin embargo, las relaciones al interior del mismo aún no han sido resueltas (Lewis, 2005), por lo que el grupo hermano de *Haematoxylum* aún no se ha definido. Recientemente se ha propuesto a *Cordeauxia* Hemsley (Haston et al., 2003), aunque Lewis (2005) encuentra esta hipótesis débilmente sustentada. También se ha propuesto dentro del grupo infragenérico Brasilettia a *Caesalpinia velutina* (Britton & Rose) Standley (Haston et al., 2005), una especie con la que comparte un tipo poco frecuente de ontogenia de los sépalos (iniciación bidireccional de los sépalos, según Tucker & Kantz [1997]), sin embargo las especies en éste grupo tienen flores unisexuales y estigmas truncados, características ausentes en *Haematoxylum* (Tucker & Kantz, 1997).

El género *Haematoxylum*, según Polhill y Vidal (1981), se distingue por presentar braquiblastos en la base de las hojas y flores, espinas, frutos no segmentados con dehiscencia en la parte media de cada valva, folíolos con nervios muy próximos entre sí y los sépalos generalmente con abscisión rápida del hipanto. Harms (1901) señala que *H. campechianum* L. llega a presentar a hojas bipinnadas, pero solamente en sus pinnas inferiores. Esta variación ha sido mencionada por diversos autores, por ejemplo McVaugh (1987), pero sin señalar una especie en particular.

Este género presenta tres especies, dos en América tropical (*Haematoxylum brasiletto* H. Karsten y *H. campechianum*) y una en África (*H. dinteri* Harms, endémica de Namibia). Harms (1901) propone dividir al género en dos secciones: la sección *Euhaematoxylum* Harms, donde incluye a *H. campechianum* por presentar hipanto pequeño no oblicuo, pétalos subiguales, inflorescencia con muchas flores (hasta 50) y hojas 4 a 5 paripinnadas y ocasionalmente casi bipinnadas (únicamente el par de pinnas inferior desarrollado), y la sección *Neohaematoxylum* Harms, donde incluye *H. brasiletto* por presentar hipanto oblicuo y ancho, pétalos iguales, inflorescencia con 12 a 20 flores y hojas 2 a 3 paripinnadas. Sin embargo filogenias modernas como la de Haston et al. (2005) rechazan esta división debido a que *H. dinteri*, con hipanto giboso (oblicuo y ancho sensu Harms [1901]), pétalos desiguales, inflorescencia con pocas flores (10 o menos) y hojas 3-paripinnadas, es el grupo hermano del clado *H. campechianum–H. brasiletto*, cuyas especies fueron utilizadas por Harms (1901) para establecer y contrastar su propuesta de secciones.

Tucker y Kantz (1997) establecen en un minucioso estudio del desarrollo comparativo (a partir de ejemplares cultivados) de la flor e inflorescencia de *Haematoxylum brasiletto* y de *H. campechianum* que la primera especie tiene flores zigomorfas y la segunda actinomorfas (simetría radial), dado que la primera tiene un hipanto con una giba y pétalos desiguales y la segunda presenta un hipanto sin giba y los pétalos son subiguales en tamaño y forma.

En la recolección y examen de ejemplares de herbario, dentro del proyecto "Estudio florístico de la

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porción guerrerense de la Cuenca del Río Balsas. Parte 1", se detectó una especie afín a *Haematoxylum brasiletto* (ambas con flores zigomorfas), caracterizada por hojas paripinnadas y biimparipinnadas, flores de forma diferente y en panículas grandes (carácter no registrado en ninguna otra especie del género), frutos falcados con dehiscencia casi marginal y diferente fenología. La especie se describe a continuación:

Haematoxylum sousanum Cruz Durán & J. Jiménez Ramírez, sp. nov. TIPO: México. Guerrero: Mpio. Atenango del Río, ca. 3.16 km al NO de Atenango del Río, bosque tropical caducifolio, 18°06′43.7″N, 99°07′14.2″O, 796 m, 25 sep. 2003 (fl), *Adriana Arellano Rivas 65* (holotipo, FCME; isotipo, MO). Figura 1.

Haematoxylo brasiletto H. Karsten affinis, sed imprimis differt foliis innatis vel bipinnatis (2.5)3 4.5(5.5) cm longis, pinnis 2- a 4-foliolatis, foliolis (5–)5.5–9(–11) × 2–4(–4.5) mm, calyce ca. 4 × 6 mm, hypanthio 2 × 6 mm longo, stigmate obliquo, cavitate parva praedito, legumine falcato (3–)4–5(5.5) × 0.9 1.1 cm.

Arbusto 2–3 m o árbol hasta 4.5 m de altura y tronco ca. 15 cm diám.; ramas rojizas a cafés, con abundantes lenticelas; espinas rectas, cónicas, 5–7 mm. *Hojas* (2.5–)3–4.5(–5.5) cm, pinnadas o biimparipinnadas; pinnas 1 a 3 pares laterales y una pinna terminal; pecíolos (3–)5–10(–13) mm; ráquis y pecíolo con glándulas apiculadas (en ocasiones pubescentes); peciólulos ca. 0.5 mm; *folíolos* 2 a 4 pares por pinna, oblanceolados (5–)5.5–9(–11) × 2–4(–4.5) mm, base oblicua, ápice emarginado, glabros (en algunos casos pubescentes). *Inflorescencias* dispuestas en panículas hasta 18 cm. *Flores* amarillas; pedicelos 10–12 mm; hipanto ca. 2 × 6 mm, amarillo-verdoso; cáliz ca. 4 × 6 mm; sépalos superiores ca. 6 × 3 mm, ápice obtuso; sépalos medios ca. 6.5 × 2 mm; sépalo inferior 6–7 × 2.5 mm, cimbiforme; estandarte ca. 10 × 8 mm, lámina amplia, base acanalada; alas ca. 10 × 8 mm, quilla ca. 9 × 6.5 mm; estambres 9–10 mm, base de los filamentos laminar, pubescentes; pistilo 12–15 mm; ovario 6–7 mm, glabro, óvulos 4 a 6; estilo ca. 7 mm, glabro; estigma oblicuo y con cavidad pequeña rodeada con pelos marginales en su borde superior. *Legumbres* (3–)4–5(–5.5) × 0.9–1.1 cm, falcadas, con venación evidente, línea de dehiscencia submarginal; *semillas* 6–8.5 × 4–5 mm, aplanadas, oblongas a reniformes, verdosas, 1 a 3 por legumbre.

Distribución y hábitat. En el estado de Guerrero, *Haematoxylum sousanum* se desarrolla en bosque tropical caducifolio con un dosel hasta 4 m de altura, en altitudes de 748 a 796 m, sobre suelos calizos. En observaciones de campo se ha detectado su asociación con *Senna wislizeni* (A. Gray) H. S. Irwin & Barneby, *H. brasiletto* (pero no florece ni fructifica al mismo tiempo que la especie nueva, según nuestras observaciones a lo largo de un año en la población guerrerense), *Marina pueblensis* (Brandegee) Barneby, *M. gracilis* Liebman, *Nissolia leiogyne* Sandwith y *Sclerocarpus* Jacquin. En el estado de Puebla se encuentra en bosque tropical caducifolio y en matorral espinoso a una altitud de 1500 a 1610 m, sobre suelos calizos y en rocas sedimentarias. En el estado de Oaxaca la especie alcanza los 3 m de altura y prospera en bosque tropical caducifolio, en suelo negro rocoso y altitudes de 1070 a 1110 m. Los pecíolos y los folíolos son pubescentes.

Conservación. En el estado de Guerrero, la especie nueva solamente se ha localizado en un área no mayor a 2 km² y su población no sobrepasa los 30 individuos. En el estado de Puebla (a unos 100 km de la población guerrerense) se ha colectado en tres localidades, pero se desconoce si son poblaciones tan reducidas como la de Guerrero. Por ello tal vez sea recomendable (por falta de conocimiento) ubicarla tentativamente como especie Vulnerable (VU) en la UICN (2001), por ocupar áreas sujetas a pastoreo intenso, porque se conocen menos de 5 poblaciones y que dichas poblaciones parecen estar fragmentadas, además por ocupar menos de 500 km² de la porción oriental de la Cuenca del Río Balsas.

Fenología. Florece en septiembre y fructifica de noviembre a diciembre (a febrero), aunque presenta frutos inmaturos desde septiembre y octubre y excepcionalmente flores en diciembre.

Etimología. El nombre de la especie está dedicado a Mario Sousa S., investigador del Herbario Nacional (MEXU), quien ha contribuido de modo notable al conocimiento de la familia Leguminosae en México y Mesoamérica.

Clave Para Diferenciar *Haematoxylum sousanum* de *H. brasiletto* y *H. campechianum*

1a. Flores actinomorfas; hipanto sin giba y con lóbulos persistentes; sépalos 4–5 mm; pétalos oblanceolados, subiguales; inflorescencias en racimos axilares . . . . . *H. campechianum*

1b. Flores zigomorfas; hipanto giboso y lóbulos caedizos; sépalos (5–)6–7 mm; pétalos anchamente obovados, desiguales, al menos los que conforman la quilla; inflorescencias en fascículos o racimos cortos sobre braquiblastos axilares (rara vez terminales) o panículas terminales en ramas normales (macroblastos).

2a. Hojas paripinnadas, rara vez bipinnadas; pedicelos ca. 15 mm; cáliz ca. 11 × 7 mm, rojizo; sépalos superiores ca. 7 × 4 mm; sépalos medios ca. 6 × 4 mm; sépalo inferior ca. 7 × 4 mm; quilla 6–8 × 4–6 mm;

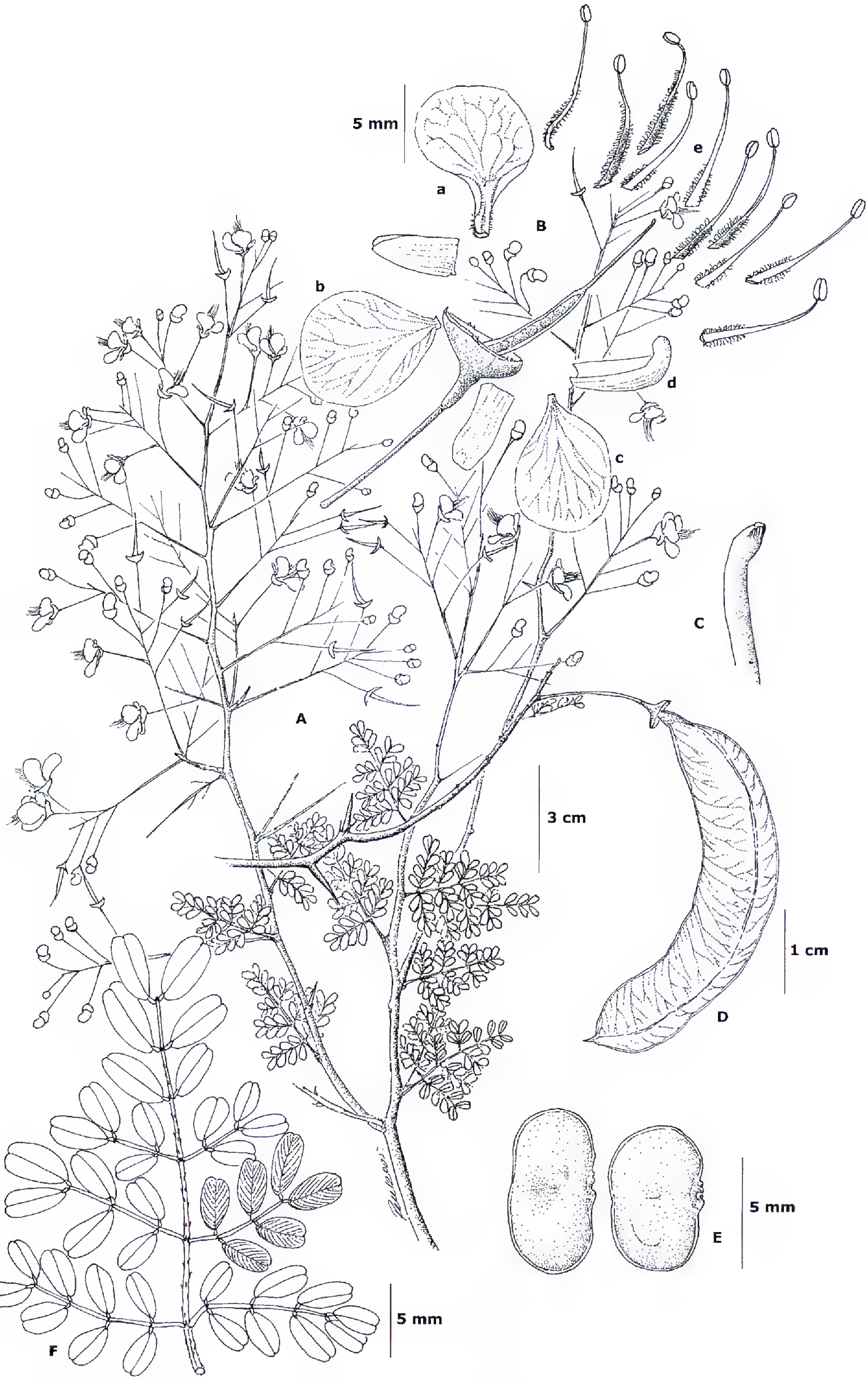

Figura 1. *Haematoxylum sousanum* Cruz Durán & J. Jiménez Ramírez. —A. Rama con inflorescencias. —B. Flor en disección (a. estandarte, b. ala, c. pétalo de la quilla, d. sépalo inferior, e. estambres). —C. Estigma. —D. Fruto. —E. Semillas. —F Hoja. A–C y F, *A. Arellano Rivas 65* (FCME); D y E, *R. Cruz & R. Aguirre 5851* (FCME). Ilustrado por Ramiro Cruz Durán.

estigma horizontal y forma una cavidad fácilmente observable; legumbre semi-recta con la línea de dehiscencia casi en el centro de cada valva; semillas 8–10 mm; floración octubre–noviembre; fructificación febrero . . . . . *H. brasiletto*

2b. Hojas siempre paripinnadas y biimparipinnadas; pedicelos 10–12 mm; cáliz ca. 4 × 6 mm, verdoso; sépalos superiores ca. 6 × 3 mm, sépalos medios ca. 6.5 × 2 mm; sépalo inferior 6–7 × 2.5 mm; quilla ca. 9 × 6.5 mm; estigma oblicuo y forma una cavidad pequeña con pelos marginales; legumbre falcada, con la línea de dehiscencia cercana al margen de cada valva; semillas 6–8.5 × 4–5 mm; floración septiembre; fructificación noviembre–diciembre . . . . .*H. sousanum*

Haematoxylum sousanum es fácil de distinguir del resto de las especies porque siempre tiene hojas paripinnadas y biimparipinnadas de manera simultánea, que surgen (solitarias o agrupadas) de braquiblastos inconspicuos y su inflorescencia es una panícula terminal que se origina en ramas de crecimiento normal (macroblastos). *Haematoxylum campechianum* puede tener las dos pinnas basales paripinnadas (Harms, 1901) y en *H. brasiletto* se llega a presentar el mismo fenómeno, según se observó en ejemplares de *Diego 7768* y *Calónico 13810* del FCME. En la clave es posible observar que el cáliz y los sépalos de *H. sousanum* son más pequeños, mientras que la quilla es más grande que en *H. brasiletto*. El periodo de floración y fructificación de la nueva especie antecede a la observada en *H. brasiletto*.

La legumbre de *Haematoxylum sousanum* se distingue del resto de las especies del género ya que casi siempre es falcada y la sutura queda casi en el margen de la valva. En *H. brasiletto* la legumbre presenta la sutura cercana a la porción central de la misma (McVaugh, 1987, la describió como excéntrica).

Finalmente, el estigma de la especie nueva tiene una cavidad pequeña rodeada en su borde superior por pelos, de manera que es muy similar al estigma crateriforme, sensu Tucker y Kantz (1997), de *Haematoxylum campechianum*, pero el de la primera especie es oblicuo y en la segunda horizontal, además, no deja de llamar la atención que *H. brasiletto*, la especie más afin a *H. sousanum*, tenga un estigma tan diferente (tubular/porado, sensu Tucker & Kantz [1997]) debido a su cavidad profunda y carencia de pelos.

Paratipos. MÉXICO. **Guerrero:** Mpio. Atenango del Río, 3.16 km al NO de Atenango del Río, 748 m, 23 nov. 2003 (fr), *R. Cruz & R. Aguirre 5851* (FCME); 3.8 km al NO de Atenango del Río, 744 m, 1 dic. 2006 (fr), *R. Cruz 6702* (FCME, MEXU); 3.8 km al NO de Atenango del Río, 725 m, 29 sep. 2006 (fr inmaturo), *R. Cruz 6652* (FCME, MEXU), 29 sep. 2006 (fl), *R. Cruz 6650* (FCME). **Oaxaca:** Mpio. Mariscala, Dto. Huajuapan de León, 1 km al N de Mariscala, 11 dic. 1992 (fl), *J. I. Calzada et al. 18280* (MEXU), 11 feb. 1993 (fr), *J. I. Calzada & A. Campos 18333* (MEXU). **Puebla:** Mpio. Petlalcingo, ladera a un lado de la carr. Acatlán–Petlalcingo, frente al cerro Yucuchicui, 1500 m, 19 sep. 1999 (fl), *A. Castañeda 638* (MEXU); Mpio. Totoltepec, paraje Loma Larga, terrenos comunales de Santa Cruz Nuevo, 1610 m, 17 oct. 1999 (fr inmaturo), *E. Guizar N. & A. G. Miranda M. 4648* (MEXU, UACH, UAMIZ); 56 km al NE de Acatlán de Osorio, rumbo a San Juan Ixcaquistla, 5 ene. 1981 (fr), *F. G. Medrano et al. BC-53* (FCME, MEXU).

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A New Species of the Genus *Hermas* (Apiaceae) from South Africa

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Abstract. A new species of the Cape endemic genus *Hermas* L. is described. *Hermas proterantha* B. J. de Villiers is a very distinct new species endemic to Piquetberg Mountain in Western Cape province. It is the only deciduous *Hermas* species and has thinly textured, deeply lobed (pinnatipartite) leaves that wither in summer.

Key words: Apiaceae, Azorelloideae, Cape flora, *Hermas*, IUCN Red List.

The genus *Hermas* L. is a group of andromonoecious dwarf shrublets, endemic to the fynbos regions of the Western and Eastern Cape provinces of South Africa. The genus was placed in the subfamily Hydrocotyloideae by Drude (1897–1898), while more recently Plunkett et al. (2004) proposed a change of rank to the subfamily Azorelloideae. This subfamily includes all genera with woody endocarps and laterally or dorsally compressed fruit. Liu (2004) tentatively placed the genus in the *Bolax* Commerson ex Jussieu group, because all previously known *Hermas* species share with this group fruit with prominent lateral wings.

The new species, *Hermas proterantha* B. J. de Villiers, has most of the characters associated with the genus but lacks lateral wings in the fruit and has very deeply lobed deciduous leaves. In Table 1, the morphological characters of *H. proterantha* are compared to those of *H. capitata* L. f., *H. quercifolia* Ecklon & Zeyher, and *H. villosa* (L.) Thunberg, showing the unique combination of characters of the new species.

Hermas proterantha B. J. de Villiers, sp. nov. TYPE: South Africa. Western Cape: Piketberg [Piquetberg], Zebra Kop, 32°45′S, 18°45′E, 16 Dec. 1979, *E. Esterhuysen 35322* (holotype, BOL). Figure 1.

Hermas proterantha B. J. de Villiers, species distincta *H. capitatae* L. f. aliquantum similis forma foliorum umbelloque parvo paucifloro, sed ab hac et speciebus omnibus aliis foliis deciduis pinnatipartitis (in speciebus aliis integra vel dentata), et in fructu absentia tota costarum vel alarum dorsalium differt.

Perennial dwarf shrublet, ca. 90 mm high (or up to 440 mm, including inflorescence). *Stem* short, cov-

Table 1. Comparison of *Hermas proterantha* with selected other species of *Hermas*.

Character	*H. proterantha*	*H. capitata*	*H. quercifolia*	*H. villosa*
Plant height (excluding inflorescence) (mm)	90	30–170	70	150–600
Petiole length (mm)	30–110	5–62	(7–)12(–22)	8–15
Lamina shape	ovate-elliptic	ovate-elliptic to cordate	obovate to ovate-elliptic	broadly lanceolate to elliptic
Leaf dimensions (mm)	(20–)40(–35) × 15–25(–52)	8–20 × 3–14	30–60 × 16–22	20–150 × 20–62
Leaf base	variably cuneate to cordate	variably cuneate to cordate	cuneate	variably cordate to subcordate
Leaf apex	mucronulate	acute to obtuse	acute	acute to apiculate
Leaf margin	pinnatipartite, the lobes dentate	slightly dentate	dentate	entire, repand and serrate
Vestiture of adaxial leaf surface	glabrous	glabrous to glabrescent	densely tomentose	glabrous
Peduncle length (mm)	300(–350)	20–340	(265–)430(–560)	240–600
No. of umbellules	5 to 12	3 to 12	7 to 28	46 to 100
Fruit shape	ovate	round to ovate	ovate	ovate
Median rib	absent	prominent	prominent becoming winged in the lower third	prominent becoming winged in the lower third
Lateral wings	absent	present	present	present

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Figure 1. Holotype of *Hermas proterantha* B. J. de Villiers in BOL.

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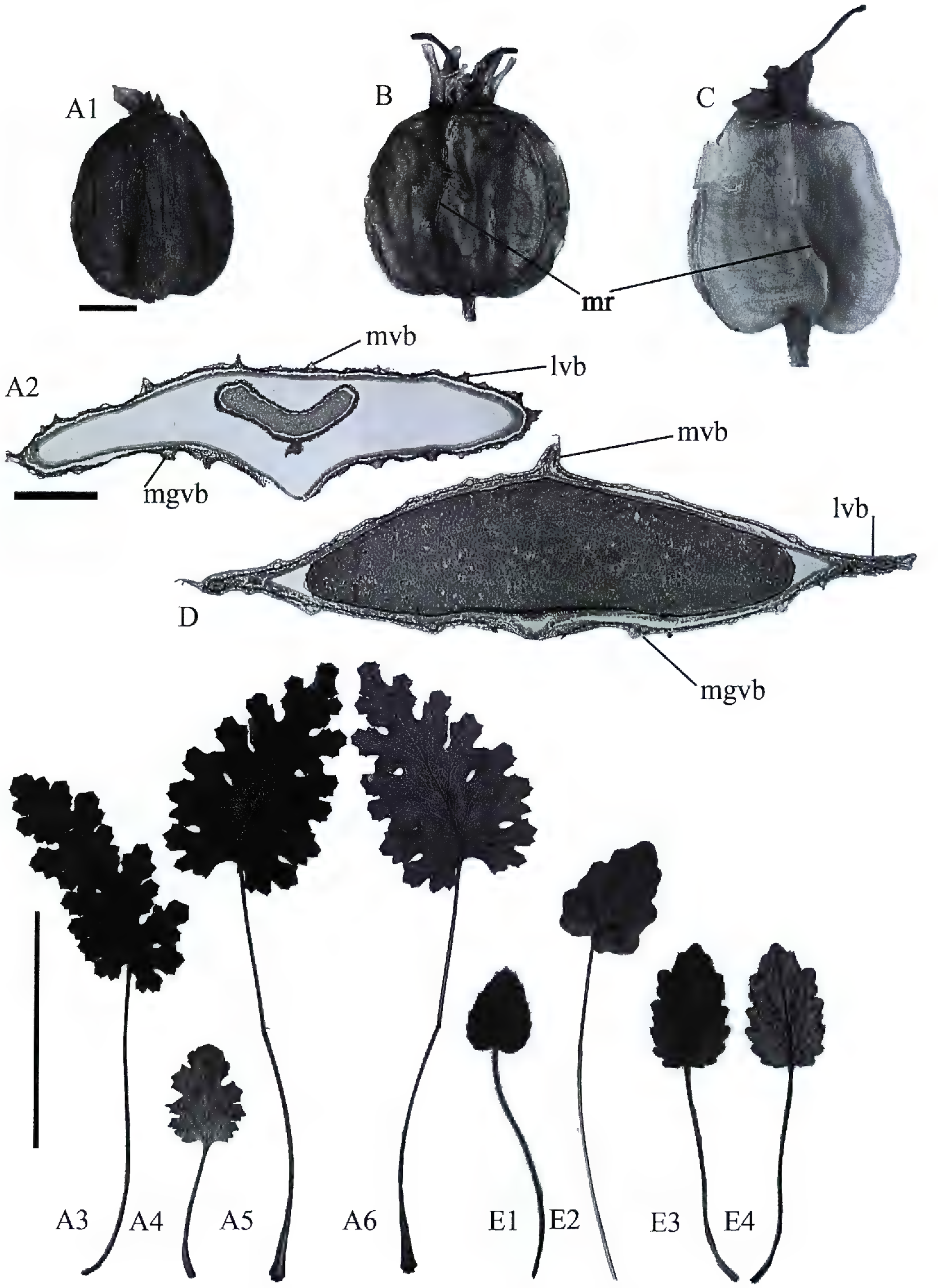
Figure 2. A comparison of the fruit and leaves of *Hermas proterantha* (A1–A6) with *H. villosa* (B), *H. quercifolia* (C), *H. quinquedentata* (D), and *H. capitata* (E1–E4). —A1. Fruit of *H. proterantha* (*Zinn 1940*, NBG) showing the absence of any vascular ridges on the dorsal side of the fruit. —B. Fruit of *H. quercifolia* (*Viviers 959*, NBG) illustrating the prominent median rib (mr = median rib). —C. Fruit of *H. villosa* (*MacOwan 128*, PRE) showing the prominent median rib that becomes winged



in the lower third. —A2. Transverse section of *H. proterantha* fruit (*Zinn 1940*, NBG) illustrating the absence of lateral wings (lvb = lateral vascular bundle, mvb = median vascular bundle, mgvb = marginal vascular bundle). —D. Transverse section of *H. quinquedentata* fruit (*Bolus 127*, PRE) indicating the presence of vascular bundles in the lateral wings. —A3–A6. Leaves of *H. proterantha* (A3, A5, A6: *Esterhuysen 35492*, BOL; A4: *Esterhuysen 36303*, BOL) displaying variation in leaf shape (A5 and A6 show adaxial and abaxial surfaces of the same leaf). —E1–E4. Leaves of *H. capitata* (E1: *Compton 8306*, NBG; E2: *Esterhuysen 4731*, BOL; E3, E4: *Andreae 1094*, NBG) illustrating variation in leaf shape (E3 and E4 show adaxial and abaxial surfaces of the same leaf). Scale bars: A1, B, C = 1 mm; A2, D = 0.2 mm; A3–A6, E1–E4 = 50 mm.

ered with remains of petioles. *Leaves* simple, on slender petioles, in basal clusters, proteranthous; petiole 30–110 mm, glabrescent; lamina ovate-elliptic, pinnatipartite (rarely pinnatifid), (20–)40–(35) × 15–25(–52) mm; base variably cuneate to cordate; apex mucronulate; margin cleft, the lobes dentate; adaxial surface green, glabrous; abaxial surface gray-white, densely tomentose; veins prominent, reticulate. *Inflorescence* with 1 to 4 umbels; peduncle slender, 300(–350) mm, densely woolly at the base; bracts on peduncle lanceolate, ca. 3 × 1 mm, revolute; umbel small, each with 5 to 12 umbellules; umbellule with 1(to 2) bisexual flowers surrounded by (3 to)6 male flowers; bracteoles paired; sepals large, petaloid, veins single in keel; petals filiform. *Fruit* ovate, dorsally strongly compressed, ca. 4 × 3 mm; lateral wings absent, marginal ribs inconspicuous, dorsal ribs inconspicuous or absent, endocarp woody.

Distribution, phenology, and etymology. The species is endemic to the Piquetberg, an isolated mountain about 105 km directly north of Cape Town. Flowering occurs from December to February and fruiting from February to April. This is the only species with deciduous leaves that wither during the dry summer months. The leaves appear long before flowering, hence the specific epithet.

IUCN Red List category. Due to the lack of information regarding the ecology, life history, and population density of the species, as well as the frequency of fire in Piquetberg Mountain, *Hermas proterantha* should be classified as DD (Data Deficient) according to IUCN criteria (IUCN, 2001).

Relationships. *Hermas proterantha* is a poorly known species represented by only four herbarium collections (on five sheets in BOL and NBG). The species is not mentioned in any of the available taxonomic literature treatments of *Hermas* (Sonder, 1862; Burtt, 1991; Goldblatt & Manning, 2000). The deeply lobed (pinnatipartite) leaves are thinly textured and quite distinct (Fig. 2A3–A6, E1–E4) when compared to those of the superficially similar *H. capitata*, where the leaves are shallowly lobed and firmly textured. In all other *Hermas* species, the leaves are persistent, but in *H. proterantha* they shrivel and die when the flowers appear in summer. The fruit of *H. proterantha* lack the prominent median ridge (Fig. 2A1) that is present (and sometimes partly winged) in all other species (Fig. 2B, C). The two mericarps shown in Figure 2 (A2 and D) are superficially similar in shape but differ in that the lateral ribs are winged in *H. quinquedentata* L. f. (and in all other species of *Hermas*), while wings are absent in the new species. Furthermore, small ribs are present between the lateral and marginal vascular bundles and represent the outer (lateral) boundary of a mericarp (Fig. 2A2).

Paratypes. SOUTH AFRICA. **Western Cape:** Piquetberg, Levant Kop, 32°42′S, 18°44′E, 13 Sep. 1980 (leaves), *E. Esterhuysen 35492* (BOL); Piquetberg, Kapiteins Kloof [Captain's Kloof], 32°46′S, 18°34′E, 22 Oct. 1935 (leaves), *N. S. Pillans 7856* (BOL); Piquetberg, Zebra Kop, 32°45′S, 18°45′E, 25 May 1986 (leaves), *E. Esterhuysen 36303* (BOL), Feb. 1940 (flowers), *H. Zinn 1940* (NBG).

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Validation of the Name *Pararuellia alata* (Acanthaceae)

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ABSTRACT. During preparation of a treatment of Acanthaceae for the *Flora of China*, it was determined that *Pararuellia alata* H. P. Tsui from Yunnan, China, was not validly published because the herbarium in which the type is conserved was not specified. The name is herein validated with the herbarium now specified. The species can be distinguished from other Chinese *Pararuellia* Bremekamp by its winged inflorescence rachis.

Key words: Acanthaceae, *Pararuellia*.

Pararuellia Bremekamp (Acanthaceae, Ruellieae) consists of about 10 species that occur in southeastern Asia and insular Malesia (Bremekamp & Nannenga-Bremekamp, 1948; Hossain, 1973; Mabberley, 1997; Tsui, 2002). In China, Tsui (2002) recognized four species: *P. alata* H. P. Tsui, *P. cavaleriei* (H. Léveillé) E. Hossain, *P. delavayana* (Baillon) E. Hossain, and *P. hainanensis* C. Y. Wu & H. S. Lo. Among these, *P. alata* was described as a new species in the addenda to volume 70 of the *Flora Reipublicae Popularis Sinicae*, but the herbarium in which its type is conserved was not specified. According to Article 37.7 of the *International Code of Botanical Nomenclature* (McNeil et al., 2006), in order to effect valid publication on or after 1 January 1990 for the name of a new species or infraspecific taxon whose type is a specimen or unpublished illustration, the herbarium or institution in which the type is conserved must be indicated. Therefore, Tsui's *P. alata* was not validly published, despite meeting all of the other requirements for publication of this new taxon. Because this species will be recognized in the forthcoming account of Acanthaceae for the *Flora of China*, it is necessary to validate Tsui's name in accordance with the Code, Article 46.2 (Ex. 9), which permits retention of the original authorship. Tsui did include a Latin description in 2002, which constitutes the validating reference, sensu the Code's Art. 36.1.

Pararuellia alata H. P. Tsui, sp. nov. *Pararuellia alata* H. P. Tsui in C. C. Hu & H. P. Tsui, Fl. Reip. Pop. Sin. 70: 346. 2002, nom inval. TYPE: China. Yunnan: Shuangjiang xian, 14 Sep. 1957, *Xin Jingsan 916* (holotype, PE; isotype, KUN). Figure 1.

This species, which is known only from Yunnan, China, is readily distinguished from other Chinese *Pararuellia* by its winged inflorescence rachis. Figure 1 shows the holotype with a detail of the winged rachis.

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Tsui, H. P. 2002. *Pararuellia*. Acanthaceae. Pp. 52–56, 346–347 *in* C. C. Hu (editor), Flora Reipublicae Popularis Sinicae, Vol. 70. Science Press, Beijing.

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Figure 1. Photograph of holotype at PE of *Pararuellia alata* (*Xin Jingshan 916*) with enlargement showing the winged inflorescence rachis.

Ctenitis dianguiensis, a New Combination and the Recircumscription of *Ctenitis subglandulosa* (Pteridophyta, Dryopteriaceae)

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ABSTRACT. In preparation for the forthcoming *Flora of China*, volume 3, the new combination *Ctenitis dianguiensis* (W. M. Chu & H. G. Zhou) S. Y. Dong based on *Ataxipteris dianguiensis* W. M. Chu & H. G. Zhou (Pteridophyta, Dryopteriaceae) is proposed. In addition, seven scientific names synonymize to *C. subglandulosa* (Hance) Ching, of which three are new: *C. maolanensis* P. S. Wang, *C. membranifolia* Ching & Chu H. Wang, and *C. yunnanensis* Ching & Chu H. Wang.

Key words: *Ataxipteris*, China, *Ctenitis*, Dryopteriaceae, fern.

In preparation for a treatment of the fern genus *Ctenitis* (C. Christensen) C. Christensen for the forthcoming volume 3 of the *Flora of China*, a new combination, *C. dianguiensis* (W. M. Chu & H. G. Zhou) S. Y. Dong based on *Ataxipteris dianguiensis* W. M. Chu & H. G. Zhou (Pteridophyta, Dryopteriaceae), is made and *C. subglandulosa* (Hance) Ching is taxonomically recircumscribed.

Ataxipteris was established as a genus by Holttum (1984) based on a single species, *A. sinii* (Ching) Holttum, which was characterized by having frond form and venation similar to that seen in *Tectaria* Cavanilles and scales resembling those seen in *Ctenitis*. Six years later, Kramer (1990) merged *Ataxipteris* into *Ctenitis*. The genus *Ataxipteris* was known to and adopted by Chinese fern taxonomists in the early 1990s (Wang, 1992; Zhang, 1993), and an additional species, *A. dianguiensis* W. M. Chu & H. G. Zhou, was described from Guangxi and Yunnan (Zhou & Zhu, 1995). Considering the distinct scales and spore features shared by the two genera *Ataxipteris* and *Ctenitis*, I agree with merging them and thus propose the following new combination.

Ctenitis dianguiensis (W. M. Chu & H. G. Zhou) S. Y. Dong, comb. nov. Basionym: *Ataxipteris dianguiensis* W. M. Chu & H. G. Zhou, in S. Y. Dong & X. C. Zhang, Acta Phytotax. Sin. 42: 376. 2004. TYPE: China. Yunnan: Xichou, 27 Jan. 1985, *W. M. Chu, H. G. Zhou & Z. L. Wu 18557* (lectotype, designated by Dong & Zhang, 2004: 376, PYU).

Ataxipteris dianguiensis W. M. Chu & H. G. Zhou was not published as a valid name in 1995 because its authors failed to designate a holotype but listed three syntypes. Dong and Zhang later validated the name in 2004 by selecting one of the three syntypes, *W. M. Chu et al. 18557*, as the lectotype. It should be pointed out that Funston (2001) had earlier selected a different syntype as type for *A. dianguiensis*. However, she erroneously noted this as a holotype and not explicitly as a lectotype (cf. Art. 9.21, McNeill et al., 2006).

Distribution and habitat. *Ctenitis dianguiensis* is endemic to China (Guangxi, Hainan, and Yunnan), growing in forested limestone areas at altitudes between 800 and 1400 m (Zhou & Chu, 1995).

Discussion. *Ctenitis dianguiensis* is a distinctive species and closely related to *C. sinii* (Ching) Ohwi from southeastern China and southern Japan. The remarkable differences between them are the scales on stipe and rachis that are subulate and spreading in *C. dianguiensis* but lanceolate and appressed in *C. sinii*. The two species group together in the genus *Ctenitis* by having these correlated characters: the lamina is 2-pinnatifid, firm and chartaceous in texture, with some veinlets arising from the pinna-rachis; and the sori are exindusiate and the perispores are coarsely folded.

Selected specimens examined. CHINA. **Guangxi:** Napo, 850 m, *H. G. Zhou 2606* (GAUA, PYU). **Hainan:** Changjiang, 900 m, *S. Y. Dong 1062* (PE). **Yunnan:** Xichou, 1350 m, *W. M. Chu et al. 21798* (GAUA, PYU).

Ctenitis subglandulosa (Hance) Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 302. 1938. Basionym: *Alsophila subglandulosa* Hance, Ann. Sci. Nat., Bot., ser. V, 5: 253. 1866. TYPE: China. Taiwan: 1864, *Oldham s.n.* (holotype, BM; isotype, K).

Ctenitis anyuanensis Ching & Chu H. Wang, Acta Phytotax. Sin. 19: 118. 1981. TYPE: China. Jiangxi: Anyuan, 1 June 1958, *C. M. Hu 2253* (holotype, PE).

Ctenitis calcarea Ching & Chu H. Wang, Acta Phytotax. Sin. 19: 118. 1981. TYPE: China. Guizhou: Dushan, 22 June 1957, *S. K. Wu s.n.* (holotype, PE).

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Ctenitis chungyiensis Ching & Chu H. Wang, Acta Phytotax. Sin. 19: 119. 1981. TYPE: China. Jiangxi: 23 June 1965, *M. X. Nie 2022* (holotype, PE).

Ctenitis maolanensis P. S. Wang, Acta Bot. Yunnan. 9: 399, fig. 2. 1987. Syn. nov. TYPE: China. Guizhou: Libo, 19 May 1984, *P. S. Wang et al. 76675* (holotype, HGAS; isotype, PYU).

Ctenitis membranifolia Ching & Chu H. Wang, Acta Phytotax. Sin. 19: 121. 1981. Syn. nov. TYPE: China. Yunnan: Pingbian, 26 Nov. 1954, *K. M. Feng 5174* (holotype, PE).

Ctenitis rhodolepis (C. B. Clarke) Ching, Bull. Fan Mem. Inst. Biol., Bot. 8: 300. 1938. Basionym: *Nephrodium rhodolepis* C. B. Clarke, Trans. Linn. Soc. London, Bot. 1: 526, t. 72. 1880. TYPE: India. Darjeeling: Aug. 1875, *Clarke 26934* (lectotype, designated by Holttum, 1985, K not seen).

Ctenitis yunnanensis Ching & Chu H. Wang, Acta Phytotax. Sin. 19: 124. 1981. Syn. nov. TYPE: China. Yunnan: 26 Mar. 1956, *Yunnan Complex Exped. 5702* (holotype, PE; isotype, KUN).

Rhizome erect or suberect or prostrate; scales at apex of rhizomes linear, reddish brown, 1.5–3 mm; stipe 40–50 cm, dark stramineous; scales above base of stipes lanceolate or ovate-lanceolate, 2–3 mm, reddish brown, appressed; scales on rachis and pinna-rachis of similar shape and color but smaller. Lamina herbaceous, ovate to triangular, 40–60 × 30–40 cm, 3-pinnate to 4-pinnatifid, pinnae in 12 to 14 pairs; basal pinnae largest, triangular, 18–22 × 12–16 cm, pinnules in 10 to 12 pairs; basal basiscopic pinnules of basal pinnae the longest, 8–10 × 2.5–3.5 cm; base of upper pinnae or lobes not obviously decurrent, without veinlets arising from rachis; veins free, distinct, no veinlets arising from pinna-rachis. Sori medial or submedial or close to terminal costules; indusium absent or present, usually fugacious, hairless. Perispore coarsely echinate.

Distribution and habitat. *Ctenitis subglandulosa* is widespread in China (Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hunan, Hubei, Jiangxi, Sichuan, Taiwan, Yunnan, and Zhejiang) and also reported in Bhutan, Sikkim, India, Vietnam, Malaysia, the Philippines, and the Pacific Islands (Holttum, 1985; Wang, 1999). In China, it grows in limestone areas at an altitude of near sea level to 1700 m.

Discussion. *Ctenitis subglandulosa* is a widespread and morphologically variable species. Especially obscure is the indusium in this species. Most specimens that I examined were lacking indusia, but I found that a few indusia were present in one population from Guangxi. After further research on the development of indusia in cultivated plants, I discovered that the indusia are thin and colorless in very early stages but then abort or are only poorly developed. Thus, it is understandable that the indusium is not observable on most herbarium materials, but in a few cases, the indusium is distinct and persistent (e.g., *K. M. Feng 13197* [KUN, PE], from Yunnan, China; *S. Mitsuta & H. Doei 396* [PYU], from Kyushu, Japan). Other highly variable characters include the size and abundance of the scales on stipes and rachis, the orange color and abundance of glands, and the abundance of hairs on the lamina. It was observed that the hairs on the abaxial laminar surface are present when the plants occur in open and dry areas (Dong, pers. obs.) but absent when the plants grow in shaded forest (Dong, pers. obs.). Mainly because of limitations of earlier understanding of the development of indusia in this species, several synonymous names were published.

It should be pointed out that the spore morphology is not always consistent in this species. For SEM study, I sampled spores from eight specimens: four representing the synonymous names *Ctenitis calcarea*, *C. chungyiensis*, *C. membranifolia*, and *C. yunnanensis*, and four samples representing *C. rhodolepis*. Two types of spore morphology were observed. One spore type is the perispore with ± smooth folds, observed in *C. calcarea*, *C. membranifolia*, and two samples of *C. rhodolepis*; the second spore morphology has a perispore with coarse echinae, observed in *C. chungyiensis*, *C. yunnanensis*, and two samples of *C. rhodolepis*. A broader survey of spore morphology and development in this complex is clearly needed.

Selected specimens examined. CHINA. **Fujian:** Zhangzhou, *P. X. Qiu 2808* (PE). **Guangdong:** Yingde, *S. Wang 163439* (KUN). **Guangxi:** Baise, 950 m, *W. M. Chu et al. 18345* (PYU). **Hainan:** Changjiang, 900 m, *S. Y. Dong 1054, 1056* (PE). **Hubei:** Hefeng, 360 m, *H. J. Li 8156* (PE). **Hunan:** *S. W. Liu 30K* (PE). **Sichuan:** Junlian, 1050 m, *X. X. Kong 5208* (PE). **Zhejiang:** Yueqing, 130 m, *X. P. Qiu & Y. P. Wu 6373* (PE).

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Estudios en Labiatae VII. *Salvia yukoyukparum*, Nueva Especie y Primer Representante de la Sección *Tomentellae* en Colombia

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Resumen. Se describe e ilustra *Salvia yukoyukparum* Fernández Alonso (Labiatae), una nueva especie endémica de la Serranía de Perijá, Colombia, asignable a *Salvia* sect. *Tomentellae* (Epling) Epling, sección no registrada previamente en territorio colombiano. Se comenta la distribución conocida y el estatus de conservación y se discuten las posibles afinidades de esta especie. Se presenta una clave para separar las especies suramericanas de la sección *Tomentellae*.

Abstract. The new species *Salvia yukoyukparum* Fernández Alonso (Labiatae) is described and illustrated; it is endemic to the Serranía of Perijá, Colombia, and is assigned to *Salvia* sect. *Tomentellae* (Epling) Epling, a section not previously recorded from Colombia. Its known distribution and conservation status is commented upon, and the possible affinities of this species are discussed. A key for the South American species of *Salvia* sect. *Tomentellae* is presented.

Key words: Colombia, IUCN Red List, Labiatae, Perijá, *Salvia* subg. *Calosphace*, *Salvia* sections *Flocculosae*, *Tomentellae*.

El género *Salvia* L. con unas 930 especies, el más extenso de la familia Labiatae, cuenta en Colombia con 83 taxones reconocidos, siendo también el más diverso de las labiadas colombianas (Wood & Harley, 1989; Fernández-Alonso et al., 2003; Fernández-Alonso & Rivera-Díaz, 2006). En la última década se adelantaron algunos trabajos en *Salvia* de Colombia que trataron diversas novedades taxonómicas y corológicas y algunos casos de hibridación natural, principalmente en las secciones *Flexuosae* (Epling) Epling, *Longipes* Epling, *Rubescentes* (Epling) Epling y *Secundae* (Epling) Epling (Fernández-Alonso, 1991, 1995a, b, c, 1996). Más recientemente, se dieron a conocer también para Colombia otras novedades de diversa índole en las secciones *Angulatae* (Epling) Epling, *Macrostachyae* (Epling) Epling, *Purpureae* (Epling) Epling, *Siphonantha* (Epling) Epling y *Tubiflorae* (Epling) Epling y se comentaron también algunos aspectos sobre fitogeografía de estos grupos (Fernández-Alonso, 2002, 2003a, b, 2006). Todas las secciones mencionadas, así como el resto de las especies de *Salvia* nativas de Colombia, se adscriben al subgénero *Calosphace* (Bentham) Bentham.

En esta contribución se presenta la descripción de una especie nueva asignable a *Salvia* sect. *Tomentellae* (Epling) Epling, sección integrada por 20 especies: nueve de México y 11 de los Andes centrales (Ruiz & Pavón, 1798; Epling, 1935–1937, 1939, 1947; Macbride, 1960; Epling & Játiva, 1968; Ramamoorthy, 1984; Zarucchi, 1993; Orfila & Farina, 1996; Harley, 1999). La sección *Tomentellae* no había sido registrada aún en territorio colombiano, y la única especie conocida del norte de Suramérica (Ecuador) *S. humboldtiana* F. Dietrich, es una planta de flores pequeñas y hojas enteras muy pequeñas, muy diferente a la que ahora se describe.

Salvia yukoyukparum Fernández Alonso, sp. nov. TIPO: Colombia. Cesar: Serranía de Perijá, Mpio. de Becerril, Corr. Siete de Agosto, entre la Cuchilla Machosolo y el Río Guajirita, 1500 m, 12 dic. 2005 (fl, fr), *J. O. Rivera-Díaz, N. J. Garzón & C. A. Vargas 2935* (holotipo, COL; isotipos, COL, HUA, MO, US). Figura 1.

Species *Salviae* sectioni *Tomentellae* (Epling) Epling tentatim adscribenda, sed ab omnibus speciebus sectionis indumento caulis, foliis (subtus) et calyce piliis ramosis praeditis, inflorescentiis spiciformibus, terminalibus vel axillaribus ad basin interruptis; bracteis lanceolatis vel ovato-lanceolatis, magnis (usque ad 6 cm longis), persistentibus, et corollae tubo ca. 15 mm longo, intus rugis binis in parte tertia distali positis differt.

Arbusto de hasta 1.8–2 m, generalmente ramoso, de ramas escandentes, gráciles; tallos cuadrangulares, marrón pálido, de 2.5–4.5 mm diám., con indumento blanco, abundante, de pelos ramosos de hasta 1 mm, enmarañado y regularmente distribuido en toda la superficie; entrenudos 2.5–6 cm. Hojas con pecíolo de 10–13 mm en la zona media e inferior del tallo y más corto en las superiores, con indumento ramoso de pelos septados, glandulares; láminas con haz verde y envés verde blanquecino o a veces (en las láminas viejas) con tinte morado, de consistencia membranosa,

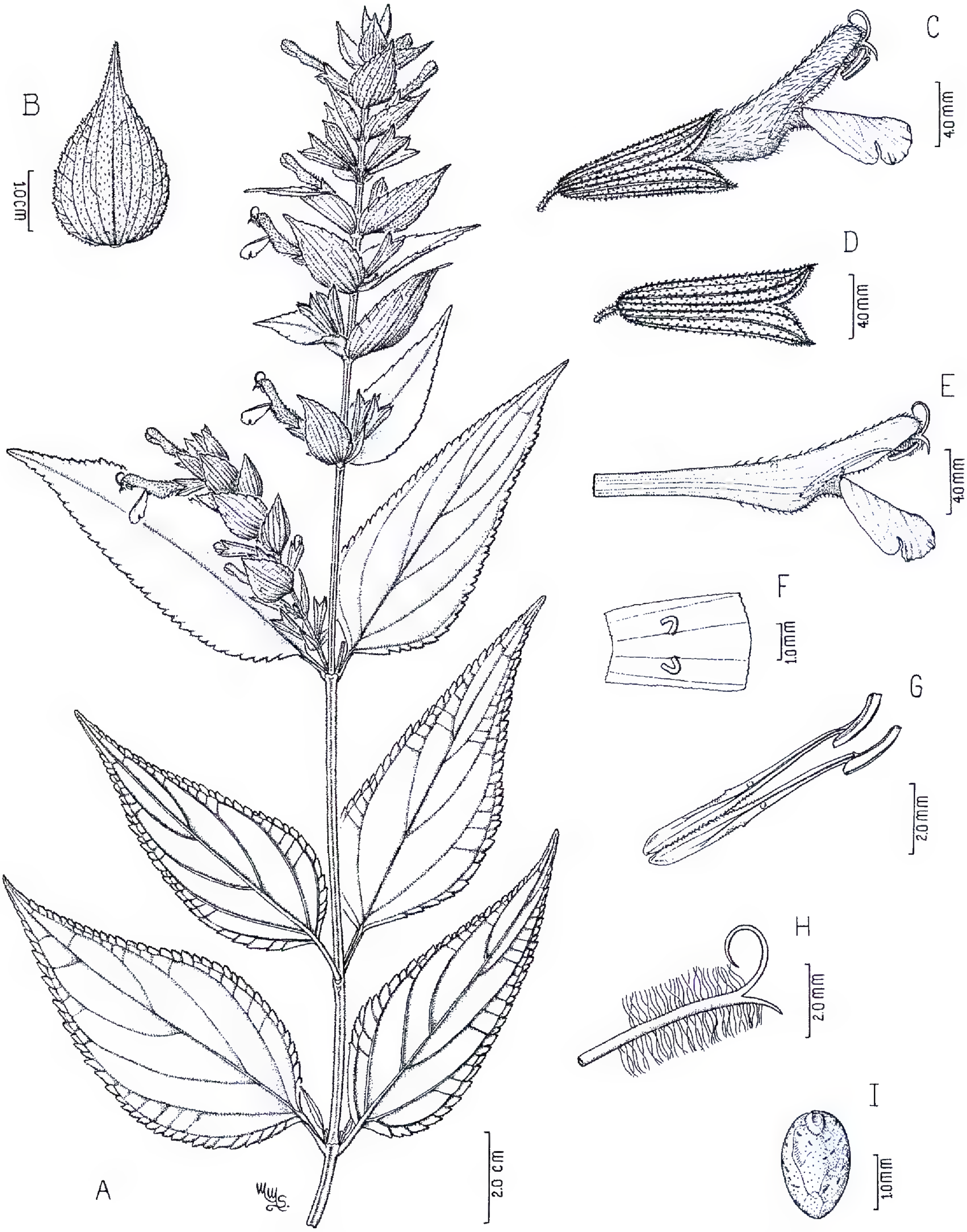

Figura 1. *Salvia yukoyukparum* Fernández Alonso. —A. Detalle de una rama con inflorescencia. —B. Bráctea de la zona media de la inflorescencia. —C. Flor. —D. Cáliz después de la antesis. —E. Corola mostrando la posición de estigmas y anteras. —F. Papilas dorsales (estaminodios), en la cara interna del tubo de la corola. —G. Conectivos estaminales con las anteras. —H. Estilo (parte distal) y estigmas. —I. Núcula. A partir del holótipo, *Rivera-Díaz* et al. *2935 (COL).*

lanceoladas u ovado-lanceoladas, 6–10(13) × 2.5–4.5 cm, de base redondeada o truncada, ápice largamente acuminado y margen gruesa y agudamente dentado-aserrada, con 4 a 5 nervios laterales a cada lado del nervio medio y con nerviación de tercer y cuarto orden reticulada, poco resaltada; glabrescentes por la haz, con glándulas y protuberancias levemente resaltadas de aspecto cristalino; en el envés con pelos

ramosos cortos, amarillentos (en seco) y también con glándulas sésiles. Inflorescencias terminales o laterales (axilares) espiciformes, interrumpidas en la base, de 10–15(20) cm de longitud; porción basal del raquis desnuda de 6–7 cm, seguida de 5 a 8(10) verticilastros; raramente con otras dos espigas laterales en la base del raquis; éste con indumento ramoso denso, de hasta 1 mm; verticilastros acompañados de brácteas foliáceas persistentes, verdes o verde-morado, lanceoladas u ovado-lanceoladas, cóncavas, las inferiores de hasta 6 × 2.5 cm, las medias y superiores 2–4.5 × 1.5–2 cm, con margen gruesamente dentada, con nervio medio marcado y 2 a 3 nervios basales a cada lado; glabrescentes, con pelos muy finos y glándulas sésiles oscuras, excavadas; los primeros 1 a 3 verticilastros (inferiores), laxamente dispuestos, separados entre sí 2–3 cm, el resto aproximado-imbricados, con 7 a 15 flores cada uno. Flores subsésiles, pedicelo floral de hasta 2 mm de longitud con indumento septado; cáliz verde o verde con tinte morado, 11–13 mm en la flor, y hasta 13.5 mm en el fruto, con labios subiguales, abiertos y cortos, subtriangulares, levemente acuminados, 2.5–3 mm, con 7 nervios conspicuos en el labio superior; con indumento amarillento (en seco), corto, ramoso y densamente dispuesto; corola azul-morado, 20–22 mm; tubo de ca. 15 mm de longitud, 2 mm de ancho en la parte basal y ensanchado-venticroso cerca de la boca del tubo, ésta de 3.5 mm de ancho, muy levemente arqueado-ascendente en el tercio distal; con dos papilas cintiformes (estaminoidales), arqueadas, de ca. 1 mm, ubicadas hacia la mitad dorsal de la corola (10–11 cm por encima de la base del tubo); labio superior de 5 mm, linear-espatulado, ligeramente galeado; labio inferior 5–6 mm, superficie externa de la corola con pelos dispersos, rectos, tenues, algunos ramificados y glandulares (ramas con cabeza glandular); estambres ubicados en el tercio distal de la corola, con filamento de 1 mm, conectivo levemente arqueado cerca de la antera, 3.5–4 mm, alojado enteramente en el labio superior de la corola y en la boca del tubo; articulación del conectivo (porción inferior) de ca. 2 mm; anteras oscuras, estrechamente cilíndricas, de 1.5 mm, arqueado-convexas después de la dehiscencia, polen amarillo; estilo 22–23 mm, con ramas estigmáticas desiguales, la superior más larga de 2–3 mm y fuertemente curvada hacia arriba formando un círculo, y la inferior dirigida hacia abajo, suberecta, de ca. 1 mm, con denso indumento de pelos cintiformes agrupado-fasciculados en la parte distal, dispuestos en un solo plano. Núculas marrones, elipsoide-ovoides, con puntuaciones diminutas, dispersas y manchas difusas de color café oscuro, de aspecto ferrugíneo, 1.9–2.1 × 1.1–1.2 mm, con abundante mucílago desecado de forma laminar (en algunas de ellas).

Hábitat y distribución. Hasta donde se conoce, se trata de una especie endémica de Colombia, de la Serranía de Perijá, en el ramal más norteño de la cordillera Oriental de Colombia. Se ha localizado entre 1400 y 1500 m, en una franja de bosque subandino alterado, creciendo en taludes y pendientes expuestas, donde es localmente abundante.

Conservación. *Salvia yukoyukparum* es conocida hasta la fecha solo por una recolección (la serie típica), de una sola localidad. La asignación de esta especie a una sección que no cuenta con otros taxones en regiones cercanas (se concentra en México y en los Andes centrales) y el hecho de que no se haya localizado en los herbarios colombianos otro material proveniente de expediciones anteriores adelantadas en la Serranía de Perijá, asignable a la especie (Rivera-Díaz & Fernández-Alonso, 2003), nos hace pensar que estamos ante un taxon endémico de distribución muy restringida en la actualidad. En este sentido, consideramos a *S. yukoyukparum* un taxon de carácter relíctico, en una sección que pudo tener una mayor presencia y distribución en el norte de Suramérica en épocas pasadas. De acuerdo con información reciente recabada en la localidad tipo, la región donde habita esta planta está sujeta a fuertes modificaciones, principalmente por fuego y limpia de vegetación secundaria, lo que impidió relocalizar los individuos vistos apenas 6 meses antes (O. Rivera, com. pers.). Por los factores mencionados: muy escasa extensión de presencia y alteración progresiva del hábitat conocido, pensamos que cabe su catalogación actual como especie amenazada según la categoría EN (En Peligro) de la IUCN (2001). Siguiendo los mismos parámetros utilizados para la categorización de la familia Labiatae en la serie Libros Rojos de las Plantas de Colombia (Fernández-Alonso & Rivera-Díaz, 2006), los criterios aplicados son los de areal pequeño y en disminución (EN B1abiii).

Etimología. El nombre de la especie hace referencia al pueblo indígena yuko-yukpa, de la familia lingüística Karib, también denominado tradicionalmente como pueblo "motilón", que tuvo y tiene en la región de Becerril, Cesar (Serranía de Perijá), alguno de sus asentamientos o resguardos (Jaramillo, 1992).

Discusión. Se asigna tentativamente *Salvia yukoyukparum* a la sección *Tomentellae* por tratarse de un arbusto provisto de pelos ramificados en tallos, hojas y cálices; labio superior del cáliz con siete nervios; corola azul, ventricosa en la mitad distal y con dos papilas cintiformes arqueadas en la cara

interna en posición dorsal (infrecuente en la sección); estambres con porción inferior del conectivo recta y entera y estilo piloso en la zona distal. Aunque esta especie puede considerarse también afín en algunos caracteres a la sección *Flocculosae* (Epling) Epling (como son el indumento ramoso y las brácteas de la inflorescencia conspicuas y persistentes), la presencia de papilas en el tubo de la corola y las hojas y flores muy grandes para lo habitual en esta sección, permiten apartarla con claridad. Podemos separar con facilidad a *S. yukoyukparum* del resto de las especies conocidas de la sección *Tomentellae*, por la combinación de caracteres: connectivo estaminal subentero, estilo hirsuto en su región distal y brácteas de la inflorescencia persistentes, de más de 2 cm de longitud y corola morado-lila. Así mismo, *S. yukoyukparum* se diferencia sin dificultad del resto de las especies de *Salvia* conocidas en Colombia por presentar: indumento ramoso en tallos, hojas y cálices; brácteas de la inflorescencia amplias y persistentes; tubo de corola de con dos papilas ubicadas internamente en la mitad distal superior y estambres no exertos, de conectivo ligeramente arqueado.

Clave Para las Especies Suramericanas de *Salvia* seccion *Tomentellae*

1a. Conectivo estaminal subentero, sin diente saliente . . . 2
1b. Conectivo estaminal con diente saliente 4
2a. Cáliz floral de 11–13 mm de longitud; estilo hirsuto. . .3
2b. Cáliz floral de 6–8 mm de longitud; estilo subglabro (Perú) . . . . . *S. vargasii* Epling
3a. Espigas cortas de 3–6 cm, con brácteas caducas de menos de 1 cm, verticilastros separados 0.5–1 cm; corola azul oscuro, tubo de la corola de ca. 20 mm (Bolivia). . . . . .*S. chorianthos* Epling
3b. Espigas largas de 10–15(20) cm, con brácteas persistentes de más de 2 cm, con verticilastros separados entre sí más de 1 cm; corola azul-morado tubo de la corola de ca. 15 mm de longitud (N de Colombia). . . . . *S. yukoyukparum* Fernandez Alonso
4a. Tubo de la corola de 13–14 mm de longitud (Perú) . . . . . *S. subscandens* Epling & Játiva
4b. Tubo de la corola de 3.5–12 mm 5
5a. Hoja entera, adelgazada en la base (Ecuador). . . . . *S. humboldtiana* F. Dietrich
5b. Hoja aserrada, redondeada, truncada o cordada en la base 6
6a. Haz suavemente cinereo-pubescente (Argentina) . . . . . .*S. lorentzii* Grisebach
6b. Haz verde, glabrescente. 7
7a. Láminas de 8–12 × 2.5–4 cm; con 6 a 12 flores por verticilastro; con dos papilas en la mitad inferior interna del tubo de la corola (Argentina) . . . . . *S. calolophos* Epling
7b. Láminas de 2–8 × 1–3 cm; con 3 a 6 flores por verticilastro; sin papilas en la cara interna del tubo de la corola 8
8a. Lámina foliar de 2–4.5 cm; tubo de la corola de 4.5–6.5 mm 9
8b. Lámina foliar de (4)4.5–8 cm; tubo de la corola de 8–12 mm (Bolivia) 10
9a. Labios del cáliz de 1–1.5 mm, subespinulosos en el ápice (Perú) . . . . . *S. cuspidata* Ruiz & Pavón
9b. Labios del cáliz de 3–7 mm, redondeado-mucronados en el ápice (Bolivia, Argentina, Chile). . . . . *S. gilliesii* Bentham
10a. Envés foliar blanco, finamente tomentoso; cáliz maduro de 11–12 mm; tubo de la corola de 12 mm. . . . . *S. retinervia* Briquet
10b. Envés foliar esparcidamente pubescente y con glándulas; cáliz maduro de 8 mm; tubo de la corola de 8–10 mm. . . . . *S. bangii* Rusby

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A New, Diminutive, Mexican Milkweed (*Asclepias*, Apocynaceae s.l.)

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Abstract. A new milkweed from the eastern and western cordilleras of Mexico is described and illustrated. *Asclepias elegantula* Fishbein is distinguished from other diminutive, linear-leaved species of the genus in montane Mexico by the claret-striped petals (unique in American *Asclepias* L.) and by the combination of very small flowers with corona segments (hoods) that are sharply deflexed from the staminal column, deeply pouched, and bear a grooved, internal appendage (horn) confluent with the dorsal margin of each hood. The species is known from only two sites with different substrates, one each in the Sierra Madre Oriental and Sierra Madre Occidental. The remarkable disjunction may be indicative of extreme rarity or the low likelihood of observing this relatively inconspicuous milkweed.

Key words: Apocynaceae, Asclepiadoideae, *Asclepias*, IUCN Red List, Mexico, milkweed.

Recent botanical exploration in the southern Sierra Madre Oriental of eastern Querétaro, Mexico, for the Flora del Bajío project has resulted in the discovery of a hitherto undescribed species of *Asclepias* L. (Apocynaceae, Asclepiadoideae). Specimens collected in June 2002 by Victor W. Steinmann and Sergio Zamudio of the Instituto de Ecología, Pátzcuaro, in the company of Raquel Galván of the Escuela Nacional de Ciencias Biológicas, were brought to the author's attention. A subsequent gathering was made at the same site by the author in the company of these collectors in July 2003. Further study revealed that another collection of this species was made in the Sierra Madre Occidental of Durango 30 years earlier by M. C. Johnston and colleagues. The species is unique among *Asclepias* in the Americas by virtue of its striped corolla lobes. It is further distinguished by a combination of vegetative, inflorescence, and coronal characters and is here described as new.

Asclepias elegantula Fishbein, sp. nov. TYPE: Mexico. Querétaro: Mpio. de Landa, 1.5 km SE of La Lagunita de San Diego, along trail to Llano Chiquito, 21°22′58″N, 99°08′32″W, ca. 2100 m, rare in oak forest with scattered *Agave*, *Arbutus*, *Juglans*, *Juniperus*, *Litsea*, *Pinus*, and *Rhus*, 11 June 2002, *V. W. Steinmann, S. Zamudio, R. Galván 2521* (holotype, IEB; isotype, MO). Figures 1, 2B–C.

Haec species a congeneris lobis corollae valde striatis, floribus perpusillis, cucullis coronae deflexis valde saccatis differt.

Perennial herb 25–40 cm tall from a slender taproot, apparently not forming thickened tuberous roots; stem single, unbranched, minutely but densely puberulent, internodes (0.9–)1.7–6.5(–9.1) cm. Leaves opposite, 5 or 6 pairs, sessile, linear, base cuneate, apex acute, the longest at midstem 6.0–7.9 cm × 1.0–2.5 mm, reduced to prophylls at the base and to bract-like leaves in the inflorescence, margin revolute, glabrous except sometimes minutely puberulent on the midvein abaxially, venation hyphodromous, a pair of glandular multicelluar trichomes (colleters) present in a stipular position. Inflorescence of 2 to 4 umbels adjacent to upper leaf axils, the last-produced sometimes appearing terminal, on minutely puberulent peduncles 0.4–1.0 cm; umbels of 5 to 9 flowers on minutely puberulent pedicels 0.4–0.6 cm. Flowers small for the genus; calyx lobes narrowly deltoid, reflexed, reddish green, 1.0 mm, abaxially puberulent; corolla lobes lanceolate, reflexed, green with prominent claret stripes converging at the apex, 3.5–4.0 mm, glabrous; gynostegium with a brown column 0.7 mm tall, corona composed of bright white deeply pouched segments (hoods) opposite the filaments, 1.1 mm tall on the dorsal surface with free proximal margins 1.9 mm tall, each hood with a white, ligulate, deeply grooved appendage (horn), adnate to the dorsal surface of the hood and emerging slightly from the hood's sinus; anthers brown, 1.7 mm, the lateral margins with corneus, deltoid "wings" broadest at base, forming entrances to the stigmatic chamber, anther-style head 1.6 mm diam. with deltoid white appendages inflexed over and appressed to the apex; pollinarium composed of a pair of lacrimiform pollinia joined by translator arms to a shiny, black corpusculum; ovary and young fruit densely covered in loosely strigose, flattened trichomes. Fruit a fusiform follicle, 11.5 cm, densely puberulent, held erect on an erect stalk composed of a pedicel 0.8 cm long and a peduncle 1.5 cm long; seeds unknown.

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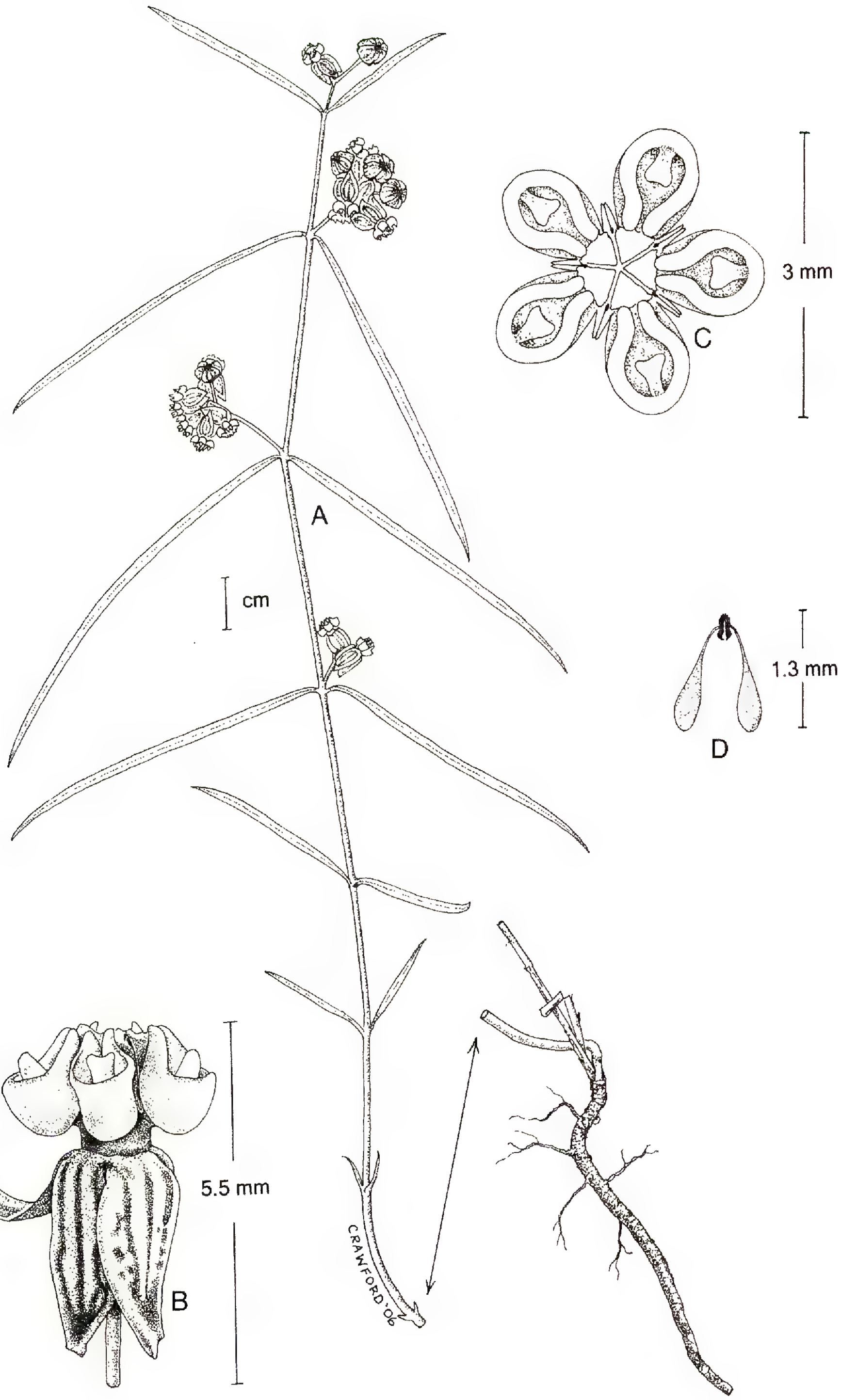

Figure 1. *Asclepias elegantula* Fishbein. —A. Habit. —B. Flower, lateral view. —C. Flower, apical view. —D. Pollinarium. Based on *Fishbein 5153* (ARIZ) and photos.

Asclepias elegantula is distinctive by virtue of several unusual features, most notably the striped petals, small flowers, deeply grooved horns, and the congested, though few-flowered, umbels. The combination of these features with the small stature, linear leaves, and deflexed corona segments provides a set of easily observed characters that readily permit identification of the new species.

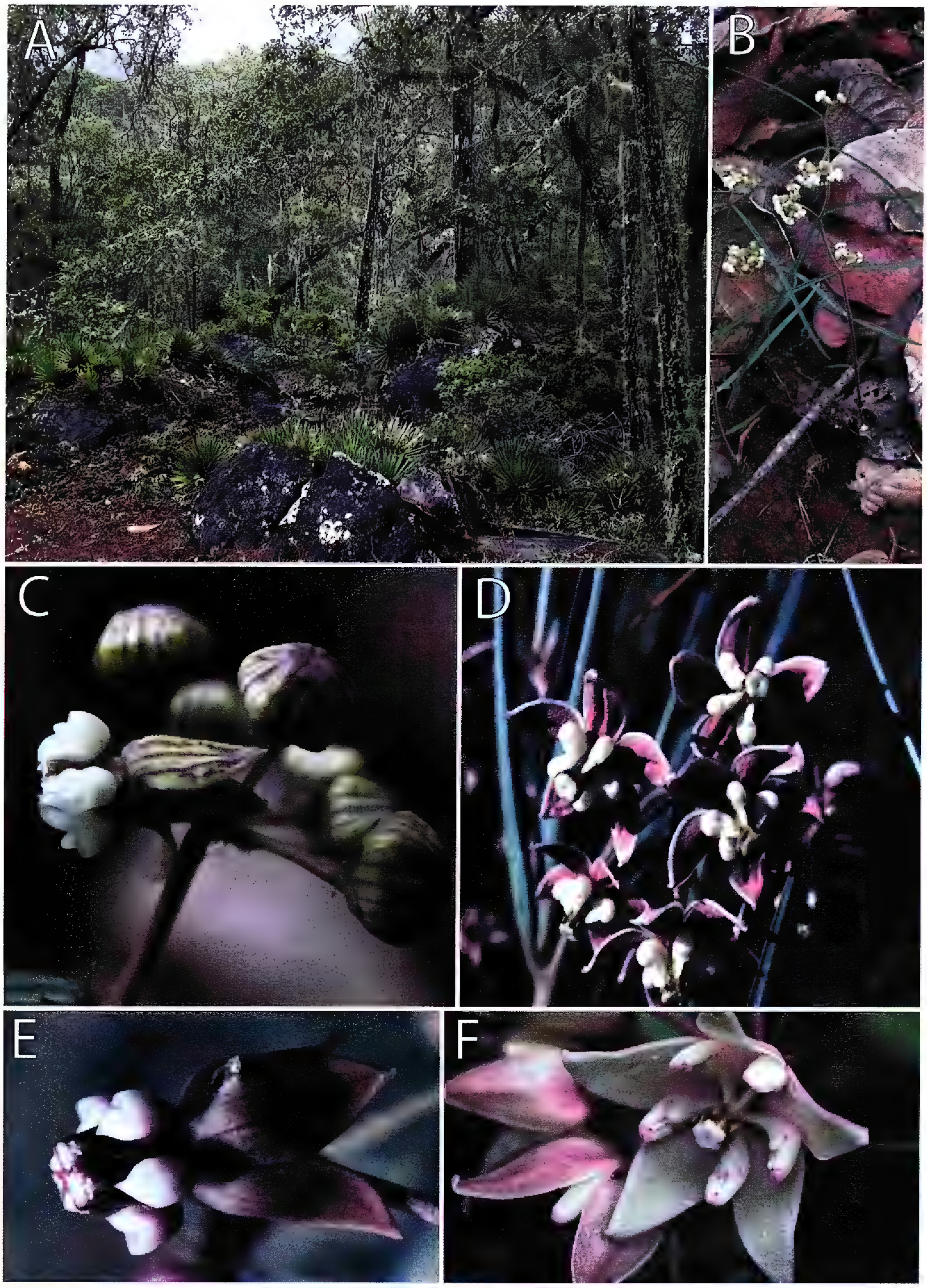

Figure 2. *Asclepias elegantula* in situ, its habitat, and similar species. —A. Pine–oak–juniper forest habitat of *A. elegantula* with *Agave*, exposed limestone, and red clay soil, municipio de Landa, Querétaro, Mexico. —B. Flowering stems of *A. elegantula* in situ; leaves of *Quercus* spp. litter the background. —C. Umbel of *A. elegantula*. —D. Umbel of *A. zanthodacryon* in Nuevo León, Mexico. —E. Flower of *A. brachystephana* in Arizona, U.S.A. —F. Flowers of *A. circinalis* in Michoacán, Mexico.

Distribution and habitat. The known distribution of *Asclepias elegantula* is remarkable, consisting of only two sites in Mexico: one in the Sierra Madre Oriental and the other in the Sierra Madre Occidental, some 700 km distant. The type locality, near La Lagunita, municipio de Landa, Querétaro, is at the head of a valley in a limestone range forming part of the southern Sierra Madre Oriental. The site is on a small ridge leading up to the main mass of the mountain range. Plants were found at 2100 m. Although the parent material at the site is limestone, *A. elegantula* was found only on deep red clay covering the bedrock. The species occurs in pine–oak–juniper forest with a somewhat open canopy, dominated by *Pinus greggii* Engelmann ex Parlatore, *P. teocote* Schlechtendal & Chamisso, *Quercus polymorpha* Schlechtendal & Chamisso, *Q. crassifolia* Humboldt & Bonpland, *Juniperus flaccida* Schlechtendal, *Juglans* L., and *Arbutus* L. (Fig. 2A). The relatively open understory harbors scattered individuals of *Rhus trilobata* Nuttall ex Torrey & A. Gray and *R. virens* Lindheimer ex A. Gray. Few other herbaceous species were observed at the time of the collections, although the presence of the congener, *A. similis* Hemsley (a robust, broad-leaved species), was noted. This location is also notable for harboring an undescribed species of *Agave* L. (R. Galván, pers. comm.). Previous collecting in Querétaro for the Flora del Bajío project did not uncover this elusive species (Argüelles et al., 1991).

Few notes are available for the other known site, west of El Salto, along the Durango–Mazatlán highway in the Sierra Madre Occidental of Durango. The sole collection from this location was made by Johnston, Wendt, and Chiang in June 1973. Remarkably, this gathering was made from a well-traveled highway that has been a fertile collecting ground for botanists since the 1950s and is one of the documented localities for another recently described milkweed, *Asclepias jorgeana* Fishbein & S. P. Lynch (Fishbein & Lynch, 1999). The floristic composition and geology of this site are dramatically different than the Querétaro locality. As noted by the collectors, the locality is on a "dissected plateau of extrusive igneous rocks." Other aspects of the ecology of the Durango site may be more similar to the Querétaro site, as the specimen was collected at 2400 m in pine forest on "sandy, grussy and black clayey soils."

IUCN Red List category. *Asclepias elegantula* is a very rare species. Johnston et al. note on their label for the Durango specimen that they found only a single plant. The original collection at the Querétaro site consisted of three individuals, and a lengthy scouring of this site in the subsequent year also turned up three plants, only one of which was in flower. Although the paucity of sites and local rarity might suggest edaphic endemism, this is apparently not the case. Instead, the widely separated localities yielding few collections of this new species may be explained by its diminutive stature and ephemeral nature. Because no evaluation of the conservation status of this species has yet been undertaken, it should be considered as a category NE (Not Evaluated) species on the IUCN Red List (IUCN, 2001); however, the existing evidence of just two, very small populations points to a preliminary assessment of EN (Endangered).

Etymology. The specific epithet refers to the elegant impression given by the slender, delicate habit and small, but artfully constructed flowers.

Relationships. *Asclepias elegantula* is quite unlike any other North American milkweed, and its closest relative is not obvious. The striped corolla lobes are unmatched by any other species in the genus (in the strict sense) and are comparable to distantly related species of *Trachycalymma* Bullock (= *Asclepias* only in the broad sense) in Africa (Goyder, 2001a, b). However, a phylogenetic study of *Asclepias* based on chloroplast (cp) DNA sequences (M. Fishbein et al., in prep.) verifies that *A. elegantula* belongs to the wholly American clade of *Asclepias* s. str. Infrageneric classification of *Asclepias* is based largely on the structure of the corona (Woodson, 1954). The strongly deflexed corona segments of *A. elegantula* are similar to those of species placed in Woodson's invalidly published subgenera *Asclepiodella* (based on *Asclepiodella* Small) and *Asclepiodora* (based on *Asclepiodora* A. Gray, to which *A. elegantula* would key). However, neither of these taxa, as circumscribed by Woodson (1954), is monophyletic in the cpDNA-based phylogeny. *Asclepiodella* is an amalgam of geographically dispersed species centered in Florida of the southeastern United States, the Colorado Plateau and dry grasslands of the southwestern United States, and the Chihuahuan Desert of the United States and Mexico. These species share saccate corona segments with truncate upper margins but seem to represent at least three distinct, geographically coherent clades in the cpDNA phylogeny. *Asclepiodora* is likewise an amalgam of species from the prairies and dry southwestern grasslands of the United States and the montane scrub and forests of Mexico. Again, these geographically disparate elements seem to represent three separate, geographically coherent cpDNA clades (M. Fishbein et al., in prep.).

The cpDNA-based phylogenetic study of *Asclepias* does not confidently identify the sister taxon of *A.*

elegantula or any close relatives (M. Fishbein et al., in prep.). However, *A. elegantula* is well supported as belonging to a major clade that consists of 22 species endemic to the Mexican highlands, including representatives of both *Asclepiodella* and *Asclepiodora*. Several species of this clade share the small stature and few pairs of linear leaves of *A. elegantula*, such as *A. zanthodacryon* (L. B. Smith) Woodson (Fig. 2D) of the Sierra Madre Oriental, *A. atroviolacea* Woodson of the Sierra Madre Occidental, and *A. circinalis* (Decaisne) Woodson (Fig. 2F) of the Sierra Madre Occidental and Sierra Madre del Sur. All of these species are likewise relatively rare and sparsely distributed. However, their flowers are considerably larger than those of *A. elegantula* (corolla lobes > 7 mm), lack the distinctive stripes on the petals, and possess differently shaped coronas. In contrast to the truncate, saccate corona segment with protruding horn of *A. elegantula* (Fig. 2C), the corona segment of *A. zanthodacryon* is laterally compressed, lacking a conspicuous sinus and horn (Fig. 2D), the corona segment of *A. atroviolacea* is a dorsiventrally compressed lamina lacking a conspicuous sinus and horn, and that of *A. circinalis* (Fig. 2F) is spatulate, dorsiventrally compressed, and lacks a conspicuous sinus and horn. The coronas of *A. elegantula* are most similar to those of *A. brachystephana* Engelmann ex Torrey (Fig. 2E), also of the Mexican highland clade. These species share small, truncate corona segments with a distinct sinus and evident horn. However, the robust, multistemmed habit, lanceolate leaves, and desert-scrub habitat of this principally Chihuahuan Desert species are dramatically different. Based upon the morphological disparity in this clade, coupled with little cpDNA sequence divergence, the new species appears to be a member of a rapidly diversifying lineage in the major sierras of Mexico.

Paratypes. MEXICO. **Durango:** Durango–Mazatlán hwy., 8 km W of El Salto, 23°45′N, 105°23′W, 2400 m, 22 June 1973, *M. C. Johnston 11437, T. Wendt, F. Chiang* (LL). **Querétaro:** Mpio. de Landa, La Mesa, along trail from La Lagunita de San Diego to Llano Chiquito, ca. 1.5 km SE of La Lagunita de San Diego, 21°23.23′N, 99°08.81′W, 2100 m, 3 July 2003, *M. Fishbein 5153, V. Steinmann, S. Zamudio, R. Galván, S. Galván* (ARIZ).

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Lectotypification and Synonymy in *Hortia* (Rutaceae)

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Abstract. During taxonomic revision of the genus *Hortia* Vandelli (Rutaceae), it was necessary to lectotypify the name *H. megaphylla* Taubert because of the destruction of the holotype at B during World War II. This name is also formally synonymized under *H. longifolia* Spruce ex Engler. The author attribution is changed for *H. longifolia* Spruce ex Engler, crediting Spruce rather than Bentham.

Resumo. Durante a revisão do gênero *Hortia* Vandelli (Rutaceae), foi verificada a necessidade de lectotipificação do nome *H. megaphylla* Taubert, em razão da destruição do holótipo depositado em B durante a Segunda Guerra Mundial. Esse nome também é formalmente sinonimizado em *H. longifolia* Spruce ex Engler. A atribuição do autor é mudada para *H. longifolia* Spruce ex Engler, dando crédito a Spruce ao invés de Bentham.

Key words: Brazil, *Hortia*, Rutaceae.

Hortia Vandelli is a Neotropical genus of Rutaceae, traditionally included in subfamily Toddalioideae, subtribe Toddaliinae (Engler, 1931). The 10 species are distributed from Panama to the state of São Paulo, Brazil, most of them occurring in the Amazonian region. They are trees or shrubs with simple leaves crowded near the apices of the branches, showy broad corymbose terminal inflorescences, reddish to pink flowers, and baccate fruits with abundant oil glands (Groppo et al., 2005).

The revision of the genus is to be accomplished by the authors, and during the process it was necessary to lectotypify the name *Hortia megaphylla* Taubert. This name is also formally synonymized under *H. longifolia* Spruce ex Engler, a taxon that encompasses individuals with an exclusively Amazonian distribution.

Hortia longifolia Spruce ex Engler, in Martius & Eichler, Fl. Bras. 12(2): 184. 1874. TYPE: Brazil. "prope Barra, prov. Rio Negro, March–Aug. 1851," *R. Spruce 1484* (holotype, BR; isotypes, BM, C not seen, C photo at F [F 22049], GH [2], IAN, K [3], K photo 2872 [of one K isotype] at MG, MO, NY).

Hortia duckei Huber, Bol. Mus. Paraense Emílio Goeldi 5(2): 424. 1909. TYPE: Brazil. Pará: "in silvis prope Faro, 17 Aug. 1907," *A. Ducke s.n.* (holotype, MG 8379; isotypes, G, G photos as F 26425 at GH, IAN, INPA 12464, MO, NY, RB 211775).

Hortia megaphylla Taubert, Bot. Jahrb. 15(2): 6. 1892. Syn. nov. TYPE: Brazil. [Amazonas:] Manaus, *Schwacke III.472* (lectotype, designated here, P; duplicates, K, R).

In the description of *Hortia megaphylla*, Taubert (1892) cited just one collection (*Glaziou 13656*). He did not cite a specific type locality, only "Brasilia, verisimiliter boreali loco non indicato" (Taubert, 1892: 6) and an observation by Schwacke that the material had been collected perhaps in Amazonia. This observation agrees with the fact that the distribution of *H. longifolia* is exclusively Amazonian.

On a duplicate specimen of *Glaziou 13656* at K, however, the locality as "environs of Rio de Janeiro" is signed as the locality of collection. This discrepancy also appears in a specimen deposited at P, which bears two labels (one in ink and another in pencil) on the same sheet; both state that the collection was made from a shrub cultivated at Quinta de São Christóvão, Rio de Janeiro, planted there by Riedel 16 April 1881. "Glaziou (n. 13656)" appears on the label in ink, but not on the one in pencil, where "Schw. III.472" is written (clearly with another pencil) in the bottom right. A specimen at R, collected in Manaus (Brazilian Amazonia) by Schwacke, clearly bears the number III.472. Thus, the collections *Schwacke III.472* (from Manaus) and *Glaziou 13656* appear to be the same, and the assumption that the type collection of *Hortia megaphylla* was made from a cultivated plant at Rio de Janeiro is probably erroneous. It is well known that Glaziou labeled collections made by Schwacke in Amazonia as

collected by himself at Rio de Janeiro (Stafleu & Cowan, 1976–1988, vol. 5: 415). This appears to be the case with the type collection of *H. megaphylla*. For details of how Glaziou incorporated specimens collected by Schwacke and Riedel into his own herbarium, see Wurdack (1970).

The specimen at B used by Taubert (1892: 6) to describe *Hortia megaphylla* ("*Glaziou 13656*," indeed *Schwacke III.472* as explained above) was destroyed during World War II. The duplicate deposited at P is thus chosen as lectotype. In addition to bearing more flowers and buds than the specimens from K and R (duplicates of *Schwacke III.472*), the P specimen bears the two labels that helped to resolve the confusion about the type collection.

Ducke (1922: 182), when he synonymized *Hortia duckei* Huber with *H. longifolia*, noted that Huber (1909) had examined only young buds to establish his new species, using the shape of the buds as the main difference between his species and *H. longifolia* (buds ovoid in *H. longifolia* vs. oblong in *H. megaphylla*). The buds of *H. longifolia* are, indeed, ovoid when young, but they become oblong just before anthesis. In the same work, Ducke commented that a collection made by Ule deposited at MG (*Ule 8926*, seen) and identified as *H. megaphylla* Taubert in sched. belonged to *H. longifolia*, without, however, printed synonymy of the name. We agree with Ducke, and *H. megaphylla* Taubert is herein formally synonymized with *H. longifolia*, based on our examination of the types of the two names.

On all examined duplicates of *Spruce 1484*, there are smaller labels naming the species as "*Hortia longifolia* sp. nov." made by Spruce himself. On the holotype of this species, however, there is another label ("Herbarium Martii") written "*Hortia longifolia* Bentham, communicatvit Bentham 1857." Nevertheless, neither Spruce nor Bentham validated the name. When Engler (1874) formally described *H. longifolia*, he attributed the species to Spruce. According to the ICBN, Art. 46.7 (McNeill et al., 2006): "in determining the correct author citation, only internal evidence in the publication...where the name was validly published is to be accepted [underline by the authors], including ascription of the name...." Therefore, *H. longifolia* Spruce ex Engler, not *H. longifolia* Bentham ex Engler, is the correct author attribution.

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Musa itinerans (Musaceae) and Its Intraspecific Taxa in China

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Abstract. *Musa itinerans* Cheesman (Musaceae) is dispersed across continental Southeast Asia from Northeast India to Vietnam and the adjacent islands, with only two previously described varieties. Its intraspecific taxa have not been comprehensively investigated. In this study, *M. itinerans* is morphologically circumscribed based on field studies in southern China. Four varieties are described as new: *M. itinerans* var. *chinensis* Häkkinen, *M. itinerans* var. *guangdongensis* Häkkinen, *M. itinerans* var. *lechangensis* Häkkinen, and *M. itinerans* var. *xishuangbannaensis* Häkkinen. We propose a new rank for *M. itinerans* subsp. *annamica* R. V. Valmayor, L. D. Danh & Häkkinen as *M. itinerans* var. *annamica* (R. V. Valmayor, L. D. Danh & Häkkinen) Häkkinen. A table for the distinguishing characteristics is provided for these varieties and for *M. itinerans* var. *itinerans* Cheesman. All of these studies are based on morphological characteristics observed in the field in China during 2005 and 2006, in various herbaria, and in the literature on Musaceae.

Key words: China, Guangdong, Guangxi, IUCN Red List, *Musa*, Musaceae, wild banana, Yunnan.

Musa itinerans Cheesman (Musaceae) is found commonly growing across continental Southeast Asia. This taxon has not had any commercial value, and for that reason it has not been dispersed by humans throughout Southeast Asia, as has been the case for its relatives *M. acuminata* Colla and *M. balbisiana* Colla (Colla, 1820). Several studies of the Musaceae in China and neighboring countries have been carried out (Fawcett, 1913; Simmonds, 1960; Li, 1978, 1981; Wu, 1979; Anderson, 1993; Li, 1996; Wu, 1997; Wu & Kress, 2000; Liu & Li, 2001; Liu et al., 2002), but none distinguish the intraspecific variation of *M. itinerans* despite its wide variation in continental Asia. *Musa itinerans* was initially named and described by E. E. Cheesman (1949) based on plants grown in Trinidad from seeds from upper Myanmar (Burma). N. W. Simmonds further issued some critical notes on the species from India and Thailand, based on his banana collecting expedition to Southeast Asia in 1954–1955, but Simmonds never visited Myanmar and his observations were based on species from India and Thailand (Simmonds, 1956a, b). Valmayor et al. (2005) described *M. itinerans* subsp. *annamica* R. V. Valmayor, L. D. Danh & Häkkinen from North Vietnam, but it has later proved to be only a variety of *M. itinerans*, based on further studies in China. Another taxonomic misidentification involved *M. wilsonii* Tutcher (1902), which was later described as *Ensete wilsonii* (Tutcher) Cheesman (Roxburgh, 1814; Cheesman, 1947). Its taxonomic identification was correctly done by Liu and Li (2001), in which they recognized it to be *M. itinerans* Cheesman. In this study it is further distinguished as *M. itinerans* var. *xishuangbannaensis* Häkkinen. Several other *M. itinerans* varieties can be observed in Hainan, Taiwan, Vietnam, Thailand, Laos, Myanmar, and India, but these taxa are subjects for further study (Häkkinen, pers. obs.).

Habitat

Most of the wild banana regions in China are located in very mountainous areas or in nature reserves, which cannot be used for agriculture. In those areas the climate varies substantially. At lower

elevations the climate is tropical to subtropical, which allows wild bananas to flower in moist ravines throughout the year. At higher elevations (up to 1800 m), especially in the north, the climate restricts the flowering period to July to September. Frost damages the growth during the winter months of December and January. The fruits ripen within three months, allowing the plant just enough time to produce seeds before the next winter season (Häkkinen, pers. obs.).

Material and Methods

This paper is based on extensive field observations made by the authors during expeditions in 2005 and 2006 to Guangdong, Guangxi, and Yunnan provinces in China. Four new varieties are described from living plants in the field by completing the entire International Network for the Improvement of Banana and Plantain (INIBAP) *Musa* descriptor list (IPGRI-INIBAP/CIRAD, 1996). The descriptive terms here also follow traditional banana taxonomy as used by Simmonds (Simmonds, 1962, 1966). Relevant portions of the specimens were deposited as holotypes at the herbaria of the Xishuangbanna Tropical Botanical Garden (HITBC) and the South China Botanical Garden (IBSC), with isotypes at H, HITBC, IBSC, MO, PE, and QBG. The first author has studied Simmonds' expedition materials from northern Thailand and northeastern India, which are now at Kew. These materials consist of samples stored in spirit as well as numerous black-and-white photos, which support the identification of *Musa itinerans* var. *itinerans* (Simmonds, 1956a, b).

1. **Musa itinerans** Cheesman, Kew Bull. 4(1): 23. 1949. TYPE: Burma [Myanmar]. Myitkyina District: Tagwin Chaung, evergreen forests, 400 ft., 24 Nov. 1928, *C. E. Parkinson 1761* (lectotype, designated by Liu et al., 2002, K).

Musa itinerans was lectotypified by Liu et al. (2002) based on a sheet at K, *C. E. Parkinson 1761*. There is also a sheet at K (H. 1171/1949) taken from the type locality (Trinidad), but it is not known if it represents original material that Cheesman used.

1a. Musa itinerans var. **itinerans** Cheesman. Figure 1A.

Variety *itinerans* is native to evergreen forest at Tagwin, Myitkyina District, in upper Myanmar and the bordering area to China in western Yunnan, where it commonly occurs. It was named from its habit of traveling from the spot where it is planted by means of its long rhizomes. In lower elevations, it flowers throughout the year in moist ravines. In higher elevations to 1800 m, its flowering period is restricted from July to September due to the effect of freezing on growth during the winter. This variety differs from the other described new varieties, but variety *xishuangbannaensis* shares its creeping long rhizome, which in variety *itinerans* can extend up to 2 m from the mother plant (Häkkinen, pers. obs.). Its chromosome number of $2n = 22$ was determined by N. W. Simmonds (1962). *Musa itinerans* varieties are easy to distinguish from the recently described *M. yunnanensis* Häkkinen & H. Wang and *M. acuminata* var. *chinensis* Häkkinen & H. Wang, as the latter have two rows of ovules per locule, whereas *M. itinerans* has four (Häkkinen & Wang, 2007).

Additional specimens examined. CHINA. **Yunnan:** Dehong Co., Yingjiang, Xima, on riverbank, Munai River, *Wang Hong 8384* (HITBC). THAILAND. *A. F. G. Kerr 3506* (K [4 sheets]).

1b. Musa itinerans var. **annamica** (R. V. Valmayor, L. D. Danh & Häkkinen) Häkkinen, stat. nov. *Musa itinerans* subsp. *annamica* R. V. Valmayor, L. D. Danh & Häkkinen, Philipp. Agric. Sci. 88: 241. 2005. TYPE: Vietnam. Yen Bai: Van Chan Distr., 30 Nov. 1994, *Le Dinh Danh 004* (holotype, Phu Ho Fruit Research Center Herbarium 005). Figure 1B.

Musa itinerans var. *annamica* was described earlier as a subspecies of *M. itinerans* from North Vietnam based on its unique method of bract opening—the bracts are revolute, but instead of rolling back, the bracts twist and curl sideways, thus exposing its whitish internal surface (Valmayor et al., 2005). However, further field studies in China support it as just a variety within the *M. itinerans* group. We propose a new varietal rank for the name. We could locate *M. itinerans* var. *annamica* only in Guangdong Province, Conghua, Daling Mountain, where we found some 10 individual plants (Häkkinen, pers. obs., 2006).

1c. Musa itinerans var. **chinensis** Häkkinen, var. nov. TYPE: China. Guangdong: Conghua, Daling Mtn., 500 m, 2 Apr. 2006, *M. Häkkinen 514* (holotype, IBSC; isotypes, H, HITBC, MO). Figure 2.

Planta usque 4 m alta, usque 12 surculos erectos prope stipitem viridem clarum, maculis latis rubro-brunneis praeditum efficiente; succo aquoso lacteo; habitu foliorum intermedio; floribus basalibus foemineis; gemmis masculinis ovatis, simul bracteas duas, revolutas, paulo cericeas, extus pallido-rubropurpureas marginibus flavis praeditas tollentibus; pericarpio maturo flavo.

Plant normal, suckering close to parent plant 10–30 cm, to 12 suckers, position vertical; mature

Table 1. Morphological comparison of *Musa itinerans* Cheesman and its six varieties.

	Var. *itinerans*	Var. *annamica*	Var. *chinensis*	Var. *guangdongensis*	Var. *lechangensis*	Var. *xishuangbannaensis*
Plant height	to 5 m	to 3 m	to 4 m	to 4.5 m	to 4 m	to 12 m
Rhizome length	2 m from parent plant	0.2–0.5 m from parent plant	0.1–0.3 m from parent plant	0.1–0.3 m from parent plant	0.1–0.3 m from parent plant	5 m from parent plant
No. of suckers	to 4 (rhizomatous)	to 7 (rhizomatous)	to 12 (clumping habit)	to 8 (clumping habit)	to 4 (clumping habit)	to 7 (rhizomatous)
Leaf habit	normal (intermediate)	normal (intermediate)	normal (intermediate)	normal (intermediate)	drooping	erect
Underlying color of the pseudostem	green	green	light green	green	light green	cream to yellow
Pigmentation of the underlying pseudostem	reddish brown	no pigmentation	large red-brown blotches	large black blotches	small purple blotches	large red-purple blotches
Sap color	watery milky	milky	watery milky	milky	watery milky	watery red
Petiole margins	erect margins	open with margins spreading	margins curved inward	erect margins	open with margins spreading	open with margins spreading
Leaf size	300 × 60 cm	170 × 70 cm	250 × 50 cm	290 × 55 cm	260 × 54 cm	500 × 105 cm
Color of leaf upper surface	dark green	green-yellow	green	medium green	dark green	dark green
Peduncle color	green to black	dark green	green to rusty brown	dark green	dark green	medium green
Peduncle hairiness	puberulent with short hairs	glabrous	puberulent with short hairs	very puberulent with short hairs	glabrous	very puberulent with long hairs
Female bud shape	ovate-lanceolate, 30 × 6 cm	lanceolate, 28 × 8 cm	lanceolate, 31 × 9 cm	lanceolate, 22 × 8 cm	obtuse, 26 × 10 cm	lanceolate, 80 × 20 cm
Female bract lifting	lifting several bracts at a time	lifting one at a time, twist and curl to side	lifting several bracts at a time	lifting several bracts at a time	lifting several bracts at a time	lifting one bract at a time
Color of the bract external face	dark purple with yellow margin	purple-red	red-purple with paler pinkish lines	red-purple with paler pinkish lines	red-purple	red-purple with paler pinkish lines
Basal flowers	female, 14 in 2 rows	female, 15 in 2 rows	female, 17 in 2 rows	female, 15 in 2 rows	female, 15 in 2 rows	hermaphrodite, 17 in 2 rows
Male bud shape	ovoid, 16 × 9 cm	lanceolate, 16 × 5 cm	ovoid, 15 × 9 cm	ovoid, 18 × 8 cm	rounded, 12 × 10 cm	intermediate, 20 × 12 cm
Color of the bract external face	dark purple with yellow margin	purple-red, no yellow margin	pale red-purple with a yellow margin	dark red-purple with a yellow margin	dark red-purple	red-purple
Male bract lifting	lifting 1 bract at a time, revolute	lifting 1 at a time, twist and curl to side	lifting 2 bracts at a time, revolute	lifting 1 bract at a time, revolute	lifting several bracts at a time, not revolute	lifting 1 bract at a time, revolute
Flowers per bract	12 in 2 rows	8 in 1 row	21 in 2 rows	15 in 2 rows	15 in 2 rows	10 in 1 row

Table 1. Continued.

	Var. *itinerans*	Var. *annamica*	Var. *chinensis*	Var. *guangdongensis*	Var. *lechangensis*	Var. *xishuangbannaensis*
No. of fruits	4 hands, 13 fruits per hand on average	6 hands, 15 fruits per hand on average	7 hands, 17 fruits per hand in 2 rows	5 hands, 15 fruits per hand in 2 rows	3 hands, 15 fruits per hand in 2 rows	9 hands, 17 fruits per hand in 2 rows
Fruit shape	10 cm, slightly curved and pronounced ridged	10 cm, curved and slightly ridged	10 cm long, slightly curved and ridged	8 cm long, slightly curved and rounded	8 cm long, straight and pronounced ridged	13 cm long, slightly curved and ridged
Pedicel	3.5 cm, glabrous	3.5 cm, glabrous	2.5 cm, glabrous	4 cm, glabrous	2.5 cm, glabrous	4 cm, puberulent
Immature fruit peel color	pale green	silvery	pale green	green to purple	light green	light green
Fruit peel color at maturity	pale yellow	rusty brown	yellow	green to purple	pale yellow	rusty brown

pseudostem to 4 m high, to 15 cm diam. at base, covered with varying amounts of dead brown leaf sheaths, underlying color light green with large red-brown blotches, shiny, sap watery milky. Petiole to 50 cm, petiole canal margins curved inward, petiole bases winged and clasping pseudostem without corrugated auricles, with sparse black-purple blotches; leaf habit intermediate, lamina to 250 × 50 cm, narrowly elliptic, truncate at apex, green abaxially and adaxially, appearance shiny, surface sparsely covered with wax coating, leaf bases asymmetric, both sides rounded and auriculate, midrib dorsally green and ventrally light green, with corrugated lamina. Inflorescence semi-pendulous and then falling vertically downward, peduncle to 30 cm, to 5 cm diam., puberulent with short hairs, green to rusty brown; sterile bracts 2, bracts persistent at the opening of first female flowers. Female bud lanceolate, to 31 × 9 cm, bracts red-purple with paler pinkish lines externally, bright yellow internally, without wax, not imbricate, lifting several bracts at a time, these revolute before falling; basal flowers female, ca. 11 cm, ovary light green, arrangement of ovules in 4 rows per locule, compound tepal ca. 4.8 cm, with 2 prominent thickened keels and hyaline margins, yellow to orange, free tepal ca. 3 cm, rounded, translucent white with thickened keel; stamens 5, without fertile pollen, ca. 4 cm, yellow; stigma ca. 0.8 cm diam., white. Male bud ovoid, ca. 15 × 9 cm, bracts pale red-purple externally with a yellow margin, bright yellow internally, with sparse wax outside, not imbricate, lifting 2 bracts at a time, these both revolute before falling; male flowers on average 21 per bract in 2 rows, falling with the bract, compound tepal ca. 4.8 cm, cream, with 2 thickened keels, ribbed at the dorsal angles, with 5-toothed orange apex, central lobes smaller than outer lobes, free tepal ca. 3 cm, translucent white, rounded, smooth, with thread-like orange apex; stamens 5, filaments white, anthers orange, anthers and style at the same level; stigma cream; ovary straight, pale green, without pigmentation. Fruit bunch lax, with 7 hands and 17 fruits per hand on average, in 2 rows, fingers curved toward the stalk, individual fruit ca. 10 cm, slightly curved and ridged, pedicel ca. 2.5 cm, glabrous, fruit apex blunt-tipped, with no floral relicts, immature fruit peel pale green, becoming yellow at maturity, immature fruit pulp white, becoming cream to brown and soft at maturity; seeds wrinkled, ca. 5 mm diam., 250 to 270 seeds per fruit.

Distribution and habitat. Variety *chinensis* occurs all over southern China in subtropical regions at elevations from 300 to 1800 m, along roadsides, in river valleys and ravines, and on steep slopes. It can

Figure 1. —A. *Musa itinerans* var. *itinerans* Cheesman, male bud. —B. *Musa itinerans* var. *annamica* (R. V. Valmayor, L. D. Danh & Häkkinen) Häkkinen, male bud. Photos by M. Häkkinen, taken in western Yunnan.

withstand seasonal frost and snow, which it faces each winter in the northern portions of its range. There frost kills the leaves, leaving the pseudostem alive from which new leaves rapidly emerge in spring, February to March. This delays any flowering to July to September in northern regions. We observed over 50 wild populations of variety *chinensis* during our field studies in Guangdong, Guangxi, and Yunnan provinces, with the individual populations varying from just a few plants up to 50. Variety *chinensis* is cultivated commonly at elevations up to 2200 m as fodder by farmers (Häkkinen, pers. obs.).

Paratypes. CHINA. **Yunnan:** Xishuangbanna, Jinghong Co., Nannuo Mtn., Gunian Zhai, *Wang Hong 7993* (HITBC); Simao, Jiangcheng Co., Lixianjiang river, *Wang Hong 8370, 8371, 8372* (HITBC); Xishuangbanna, behind Mangme hill, from Menglun to Jinghong, *Wang Hong 8374, 8375, 8376* (HITBC); Jinghong Co., on hill behind Akelaozhai village, *Wang Hong 8380* (HITBC).

1d. Musa itinerans var. **guangdongensis** Häkkinen, var. nov. TYPE: China. Guangdong: Conghua, Daling Mtn., 282 m, 2 Apr. 2006, *M. Häkkinen 515* (holotype, IBSC; isotypes, H, HITBC, MO). Figure 3.

Planta usque 4.5 m alta, usque 8 surculos erectos prope stipitem viridem, latis nigris maculis praeditum efficiente; succo lacteo; habitu foliorum intermedio; floribus basalibus foemineis; gemmis masculinis ovatis simul bracteam unicam, revolutam, paulo cericeam, extus atro-rubropurpuream margine flavo praeditam tollentibus; pericarpio maturo ferrugineo-brunneo.

Plant normal, suckering close to parent plant 10–30 cm, to 8 suckers, position vertical; mature pseudostem to 4.5 m high, to 15 cm diam. at base, covered with varying amounts of dead brown leaf sheaths, underlying color green with large black blotches, shiny, sap milky. Petiole to 50 cm, petiole canal wide with erect margins, petiole bases not winged and clasping the pseudostem with corrugated auricles and sparse black-purple blotches; leaf habit intermediate, lamina to 290 × 55 cm, narrowly elliptic, truncate at apex, medium green adaxially, light green abaxially, appearance shiny, surface sparsely covered with wax coating, leaf bases asymmetric, both sides rounded and auriculate, midrib dorsally and ventrally light green, with very corrugated lamina. Inflorescence semi-pendulous and then falling vertically downward, peduncle to 40 cm, to 5.5 cm diam., densely puberulent with short hairs,

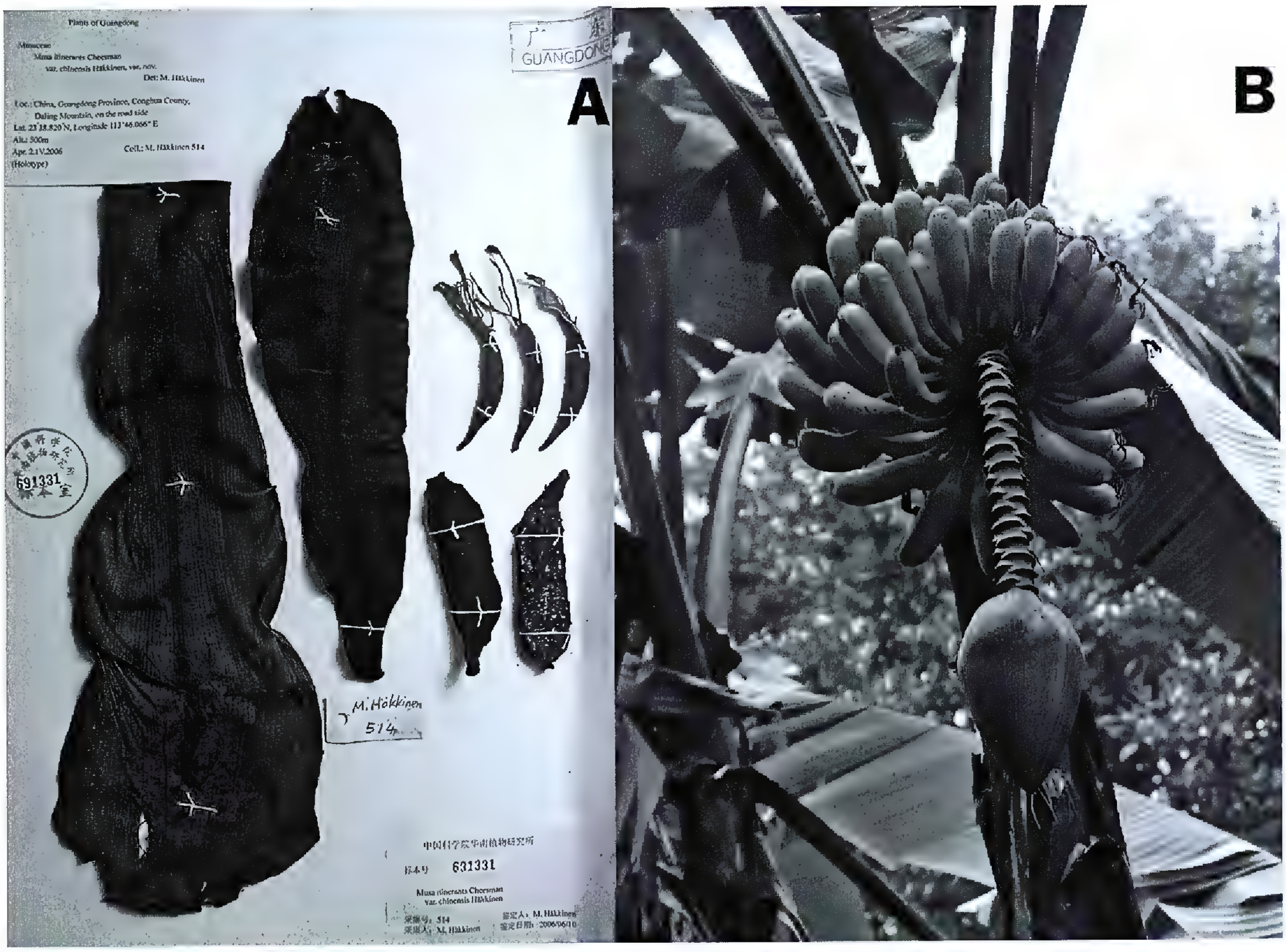

Figure 2. —A. *Musa itinerans* var. *chinensis* Häkkinen. Holotype *M. Häkkinen 514*, IBSC. —B. Inflorescence of variety *chinensis*. Photos by Xiangying Wen from IBSC (A), and M. Häkkinen from Guangdong (B).

dark green, sterile bracts 2, bracts deciduous at opening of first female flowers. Female bud lanceolate, to 22 × 8 cm, bracts red-purple with paler pinkish lines externally, bright yellow internally, without wax, not imbricate, lifting several bracts at a time, these revolute before falling; basal flowers female, ca. 11 cm, ovary pale yellow, arrangement of ovules in 4 rows per locule, compound tepal ca. 4.8 cm, with 2 prominent thickened keels and hyaline margins, bright yellow, free tepal ca. 3 cm, rounded, translucent white with thickened keel; stamens 5, without fertile pollen, ca. 4 cm, yellow, stigma diam. ca. 0.8 cm, white. Male bud ovoid, ca. 18 × 8 cm, bracts dark red-purple externally, bright yellow internally, with sparse wax outside, not imbricate, lifting one bract at a time, these revolute before falling, soon deciduous; male flowers on average 15 per bract in 2 rows, falling with the bract, compound tepal ca. 5.5 cm, yellow to orange with 2 thickened keels, ribbed at the dorsal angles, with 5-toothed orange apex, central lobes smaller than outer lobes, free tepal ca. 2 cm, translucent white, ovoid, smooth, with thread-like apex, stamens 5, filaments white, anthers yellow to orange, anthers and style exserted; stigma cream; ovary arched, light green. Fruit bunch lax, with 5 hands and 15 fruits per hand on average, in 2 rows, fingers curved toward the stalk, individual fruit ca. 8 cm, slightly curved, rounded, pedicel ca. 4 cm, glabrous, fruit apex blunt-tipped, with no floral relicts, immature fruit peel green to purple, pedicel and apex medium green, remaining green to purple at maturity, immature fruit pulp white, becoming cream to brown and soft at maturity; seeds wrinkled, ca. 5 mm diam., 200 to 220 seeds per fruit.

Distribution and habitat. Variety *guangdongensis* occurs in the northern part of Guangdong Province in temperate regions at elevations from 300 to 1600 m, along roadsides, ravines, and on steep slopes. It can withstand seasonal frost and snow, which it faces each winter from December to January in northern parts of its growing region. There frost kills the leaves, leaving the pseudostem alive from which new leaves rapidly emerge in the spring. This delays flowering to July to September. We observed some 40 wild populations of variety *guangdongensis* during our field studies in Guangdong Province, with the individual plants varying from just a few to up to 10. Variety *guangdongensis* is cultivated commonly as fodder by farmers (Häkkinen, pers. obs.).

Figure 3. —A. *Musa itinerans* var. *guangdongensis* Häkkinen. Holotype *M. Häkkinen 515*, IBSC. —B. Inflorescence of variety *guangdongensis*. Photos by Xiangying Wen from IBSC (A), and M. Häkkinen from Guangdong (B).

Paratypes. CHINA. **Guangdong:** Lechang Co., Beixiang, *M. Häkkinen 517, 518* (IBSC).

1e. Musa itinerans var. **lechangensis** Häkkinen, var. nov. TYPE: China. Guangdong: Lechang Co., Beixiang, 343 m, 1 May 2006, *M. Häkkinen 516* (holotype, IBSC; isotypes, H, HITBC, MO). Figure 4.

Planta usque 4 m alta, usque 4 surculos erectos, proxime ad stipitem viridem clarum, parvis purpureis maculis praeditum efficiente; succo aquoso lacteo; habitu foliorum demisso; floribus basalibus foemineis; gemmis masculinis rotundatis simul bracteas plures, non revolutas, extus atro-rubropurpureas tollentibus; pericarpio maturo pallide flavo.

Plant normal, suckering close to parent plant 10–30 cm, to 4 suckers, position vertical; mature pseudostem to 4 m high, to 15 cm diam. at base, covered with varying amounts of dead brown leaf sheaths, underlying color light green with purple blotches, shiny, sap watery milky. Petiole to 45 cm, petiole canal open with margins spreading, petiole bases not winged and not clasping the pseudostem with corrugated auricles and small black-purple blotches; leaf habit drooping, lamina to 260 × 54 cm, narrowly elliptic, truncate at apex, dark green adaxially, light green abaxially, appearance shiny, surface sparsely covered with wax coating, leaf bases symmetric, both sides rounded and auriculate, midrib dorsally light green and ventrally yellow, with very corrugated lamina. Inflorescence semi-pendulous and then falling vertically downward, peduncle to 30 cm, to 4 cm diam., glabrous, dark green, sterile bracts 2, bracts deciduous at opening of first female flowers. Female bud obtuse, to 26 × 10 cm, bracts dark red-purple externally, bright yellow internally, with sparse wax outside, not imbricate, lifting several bracts at a time, these not revolute before falling; basal flowers female, ca. 12 cm, ovary pale green, arrangement of ovules in 4 rows per locule, compound tepal ca. 5.8 cm, with 2 prominent thickened keels and hyaline margins, cream, free tepal ca. 3.1 cm, ovoid, translucent white with thickened keel; stamens 6, without fertile pollen, ca. 2 cm, brown, stigma ca. 0.8 cm diam., cream. Male bud rounded, ca. 12 × 10 cm, bracts dark red-purple; male flowers on average 15 per bract in 2 rows, falling with the bract, compound tepal ca. 5.5 cm, cream with 2 thickened keels, ribbed at the dorsal angles, with 5-toothed orange apex, central lobes smaller than outer lobes, free tepal ca. 2 cm, translucent white, ovoid, smooth, with thread-like apex; stamens 5, filaments white,

Figure 4. —A. *Musa itinerans* var. *lechangensis* Häkkinen. Holotype *M. Häkkinen 516*, IBSC. —B. Inflorescence and leaf part of variety *lechangensis*. Photos by Xiangying Wen from IBSC (A), and M. Häkkinen from Guangdong (B).

anthers brown, anthers exserted, style inserted; stigma cream; ovary arched, cream. Fruit bunch lax, with 3 hands and 15 fruits per hand on average, in 2 rows, fingers pointed outward from the stalk, individual fruit ca. 8 cm, straight, pronounced ridges, pedicel ca. 2.5 cm, glabrous, fruit apex almost rounded, with no floral relicts, immature fruit peel pale green, becoming pale yellow at maturity, immature fruit pulp white, becoming cream to brown and soft at maturity; seeds wrinkled, ca. 5 mm diam., 200 to 220 seeds per fruit.

Distribution and habitat. We found variety *lechangensis* only in one ravine, in Beixiang in north Guangdong, with only a few individual plants without any frost damage in April. It is notable that all of the wild and cultivated plants of variety *guangdongensis* in adjacent areas had severe frost damage during the previous winter (2005–2006), despite being located in a subtropical region at a rather low elevation (300 to 500 m) (Häkkinen, pers. obs.).

1f. Musa itinerans var. **xishuangbannaensis** Häkkinen, var. nov. TYPE: China. Yunnan: Xishuangbanna, Jinhong Co., 1154 m, 20 July 2005, *M. Häkkinen 510* (holotype, HITBC [12 sheets]; isotypes, H, IBSC, MO, QBG). Figure 5.

Planta gigantea, usque 12 m alta, usque 7 surculos erectos, semotos e stipite cremeo vel flavo, latis rubropurpureis maculis praedito efficiente; succo aquoso rubro; habitu foliorum intermedio flabelliformi; floribus basalibus hermaphroditis; gemmis masculinis ovato-rotundatis, simul bracteam unicam, revolutam, paulo cericeam, extus rubropurpuream, intus flavam claram tollentibus; pericarpio maturo ferrugineo-brunneo.

Plant huge, robust, sparsely suckering in many instances, to 5 m from parent plant, to 7 suckers, position vertical; mature pseudostem to 12 m high, to 50 cm diam. at base, covered with varying amounts of dead brown leaf sheaths, underlying color cream to yellow with large red-purple blotches, shiny, sap watery red. Petiole to 100 cm, petiole canal open with margins spreading, petiole bases not winged and clasping the pseudostem with corrugated auricles and sparse red-purple blotches; leaf habit erect, top-like, lamina to 500 × 105 cm, narrowly elliptic, truncate at apex, dark green adaxially, light green abaxially, appearance dull, surface sparsely covered with wax coating, leaf bases asymmetric, both sides rounded and auriculate, midrib dorsally medium green, ventrally orange to red-purple, with very corrugated lamina. Inflorescence first horizontal then pendulous, peduncle to 45 cm, to 7 cm diam., densely puberulent

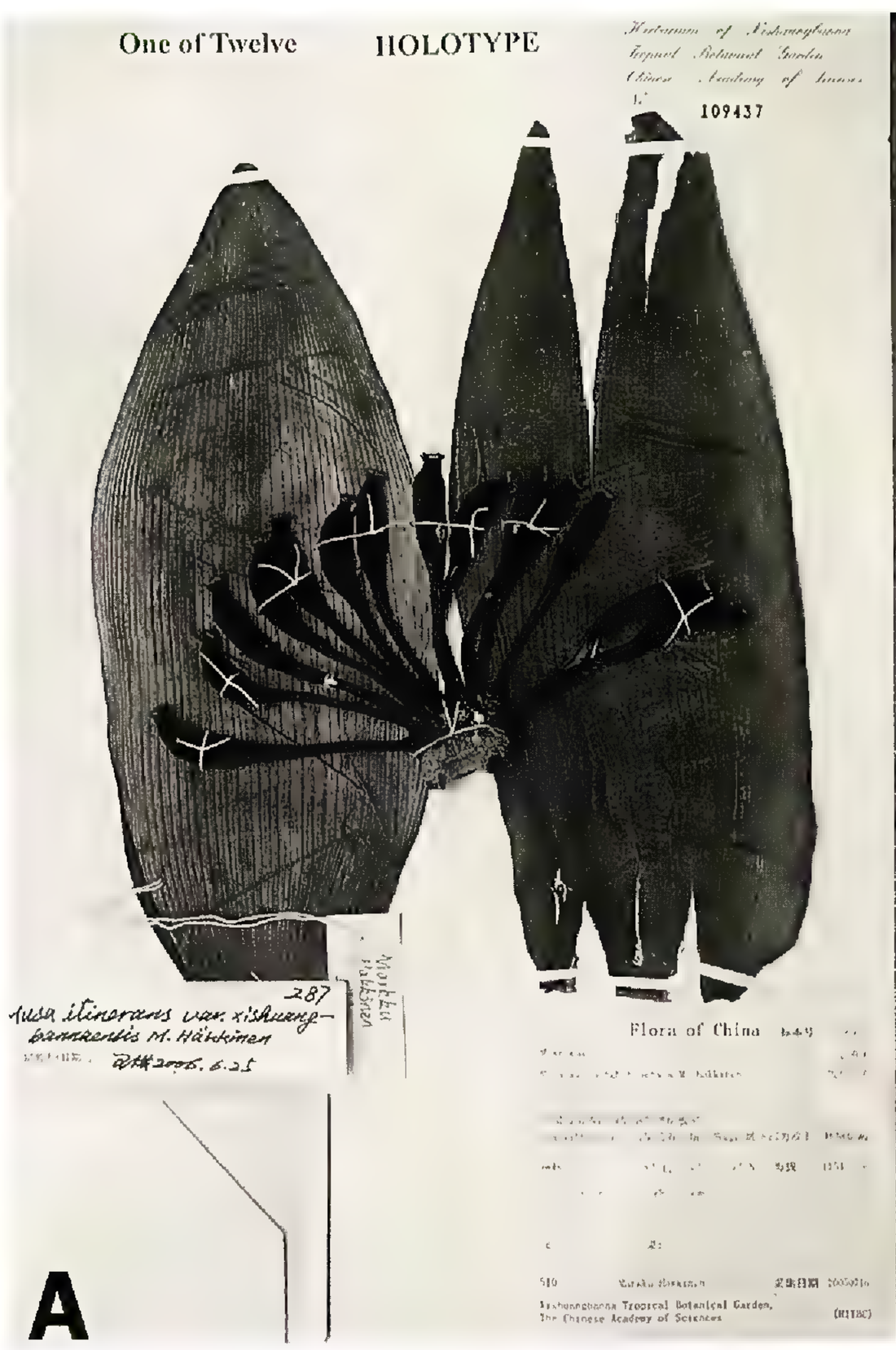

Figure 5. —A. *Musa itinerans* var. *xishuangbannaensis* Häkkinen. Holotype *M. Häkkinen 510*, HITBC. —B. Male bud and bract and ripe fruit of variety *xishuangbannaensis*. Photos by Wang Hong from HITBC (A), and M. Häkkinen from southern Yunnan. (B).

with long hairs, medium green, sterile bracts 2, bracts deciduous at opening of first female flowers. Female bud lanceolate, to 80 × 20 cm, bracts red-purple with paler pinkish lines externally, bright yellow internally, without wax, not imbricate, lifting one bract at a time, these not revolute before falling; basal flowers hermaphrodite, ca. 12 cm, ovary light green, arrangement of ovules in 4 rows per locule, compound tepal ca. 6 cm, with 2 prominent thickened keels and hyaline margins, cream to yellow, free tepal ca. 2.3 cm, oval, translucent white with thickened keel and orange lobe; stamens 5, with fertile pollen, style ca. 4.6 cm, cream to light green, stigma ca. 1 cm diam., white. Male bud lanceolate, ca. 20 × 12 cm, bracts red-purple externally, bright yellow internally, with sparse wax outside, not imbricate, lifting one bract at a time, these revolute before falling; male flowers on average 10 per bract in 1 row, falling with the bract, compound tepal ca. 5 cm, cream with 2 thickened keels, ribbed at the dorsal angles, with 5-toothed orange apex, central lobes smaller than outer lobes, free tepal ca. 2.6 cm, translucent white, rounded, smooth, with thread-like orange apex, stamens 5, filaments cream, anthers yellow, anthers and style exserted; stigma orange; ovary arched, cream. Fruit bunch compact, with 9 hands and 17 fruits per hand on average, in 2 rows, fingers curved toward stalk, individual fruit ca. 13 cm, slightly curved, slightly ridged, pedicel ca. 40 mm, puberulous, fruit apex pointed, with no floral relicts, immature peel light green, becoming rusty brown at maturity, immature fruit pulp white, becoming cream to brown and soft at maturity; seeds wrinkled, ca. 6 mm diam., 150 to 180 seeds per fruit.

Distribution and habitat. At 12 m, variety *xishuangbannaensis* is the second largest known wild banana in the world after *Musa ingens* Simmonds (1960) from Papua New Guinea, which reaches 15 m in height. In the southern regions of Yunnan, this plant is a common pioneer species in the succession process, after tropical rainforests have been destroyed. It also grows in isolated canopy gaps in upper mountainous valleys and slopes with moist fertile soils, to 1600 m in elevation. These plants grow vigorously and often develop in monomorphic communities. It has a huge corm, up to 1 m high and 0.5 m in diameter, that can store a significant amount of nutrition and water for the dry season. It can

tolerate the seasonal frost without damage, which occurs from December to January at higher elevations in Xishuangbanna. The flower buds are commonly sold in markets for human consumption, and the inner part of the pseudostem is used for refreshment. We observed some 10 populations, each consisting of 10 to 20 individuals.

Paratypes. CHINA. **Yunnan:** Xishuangbanna, Jinghong Co., *M. Häkkinen 511, 512, 513* (HITBC); Longpa village, *Wang Hong 8301* (HITBC); Mengla Co., E Xiaola hwy., 10 km from Mengyuan village, *Wang Hong 8337* (HITBC); Guangnali village, *Wang Hong 8365, 8366, 8367, 8368* (HITBC); Mengla Co., Menglun village, *He Li-qing 30, 32, 35, 37* (HITBC).

IUCN Red List categories. Six distinct varieties of *Musa itinerans* have been studied by the authors in China in 2005 and 2006. For their conservation assessment, IUCN Red List categories were applied (IUCN, 2001). Variety *itinerans* has 20 known wild populations in the border area west of Yunnan and continuing toward Myanmar (Häkkinen, pers. comm.) and can probably be considered Least Concern (LC). In contrast, only a few plants of variety *annamica* were seen in one ravine near Conghua, Guangdong, and another population of a few plants in Yen Bai, Vietnam. This taxon is of conservation concern and should be considered Vulnerable (VU), but further study is needed. Variety *chinensis* had 50 known wild populations spread over three provinces, and its status can be assessed as LC. Variety *guangdongensis* has 40 known wild populations across Guangdong and can be assessed as LC. Only a few plants of variety *lechangensis* were seen in one ravine in Beijiang, Guangdong. This variety must be considered of conservation concern, at a minimum assessment of VU. Finally, the striking variety *xishuangbannaensis* had 10 known wild populations across Xishuangbanna and can be assessed as LC.

Conclusion. Six distinct varieties of *Musa itinerans* have been studied by the authors. Four are described herein as new varieties, and one variety is established by a rank change from subspecies. It became quite evident during this study that *M. itinerans* is native to southern China, occurs across China's wild banana region, and has evolved into several different forms. However, varieties in countries neighboring China still remain poorly understood and should be subject to further study. Newly described varieties of *M. itinerans* may have breeding value in that these plants are cold tolerant and can stand temperatures several degrees below freezing. Severe freezing and snow cause the leaves to die off, but new leaves rapidly reappear when warmer weather arrives in February. The plants can still flower in early autumn (July to September) and produce mature fruits before the next freeze comes in December. These varieties have also evolved drought tolerance, withstanding seasonal droughts between October and May due to the monsoonal climate in the Guangdong and Yunnan provinces. They appear disease resistant, as no common banana diseases have been observed in any of the wild populations. They are commonly cultivated throughout rural areas, principally as fodder at 2200 m elevation (Häkkinen, pers. obs.).

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Lectotypification of *Sambucus chinensis* (Caprifoliaceae) and a New Variety from Hunan, China

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ABSTRACT. Lectotypification is provided here for *Sambucus chinensis* Lindley (Caprifoliaceae), and the rare, new variety, *S. chinensis* var. *pinnatilobatus* G. W. Hu, from Hunan province in China, is described and illustrated from two populations. It differs from *S. chinensis* var. *chinensis* in leaflet shape, fruit and pyrene size, and the adaxial epidermis of the leaf blades. The new variety's leaflets on imparipinnate leaves are pinnatipartite or pinnatisect and some leaflet lobes are irregularly pinnatilobate; fruit diameters range from 3.3–3.8 mm (average 3.5 mm); pyrene lengths range from 1.5–1.9 mm (average 1.7 mm); and the epidermal cells of the adaxial leaf surface are irregularly shaped, with sinuous or sinuate anticlinal walls. In comparison, the autonymic variety's leaflets on imparipinnate leaves are not lobed and have serrate margins; fruit diameters range from 4.0–4.8 mm (average 4.3 mm); pyrene lengths range from 2.1–2.5 mm (average 2.2 mm); and the epidermal cells of the adaxial leaf surface are polygonal, with straight or arched anticlinal walls. A chromosome number of $2n = 36$ is reported for the new variety.

Key words: Caprifoliaceae, China, Hunan, IUCN Red List, *Sambucus*.

The genus *Sambucus* L. is composed of ca. 20 species, occurring in North America, Asia, Europe, northern Africa, the West Indies, and the Andean region of South America. It is reported that there are approximately five to seven species (four or five endemic) in the genus *Sambucus* in China (Hu, 1988), but Yang et al. (pers. comm.) only accepts four taxa for the upcoming *Flora of China* treatment. Two *Sambucus* species are reported in Hunan province in central China: *S. chinensis* Lindley and *S. foetidissima* Nakai (Qi & Yu, 2002).

Sambucus chinensis is a large herb, widely distributed from central to southern China and also reported in Japan and Myanmar. When Lindley (1826: 297) originally described the taxon, he failed to designate a type, only mentioning "Plants of a species of Elder were imported by the Society in 1822, from China." Although many researchers since Lindley have studied the *Sambucus* species of Asia (Hara, 1983; Fukuoka, 1987; Bolli, 1994), no one has provided lectotypification for *S. chinensis*, which is therefore necessary (Art. 9.9; McNeill et al., 2006). To designate a lectotype for this species, one of the authors (GM), searched through the herbarium of the Department of Plant Sciences, University of Cambridge (CGE), where John Lindley's herbarium resides with its many species collected on 19th-century expeditions. She determined that only one specimen of *S. chinensis* existed in Lindley's herbarium. This specimen is in very good condition despite being collected in 1824 (Fig. 1). On it in Lindley's handwriting is "China. H. HS. 1824 Oct." and "*Sambucus chinensis* Lindl. [underline in original]," which indicates that it may be the exact specimen that Lindley used to describe this species in 1826. We designate it herein as lectotype.

In 2001, on Yuelu Mountain of Changsha (the capital city of Hunan province), we found a *Sambucus* plant population with imparipinnate leaves and pinnatipartite or pinnatisect leaflets. Otherwise, the *Sambucus* plants found were morphologically similar to *S. chinensis* Lindley. After searching the literature

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Figure 1. Lectotype of *Sambucus chinensis* Lindley.

(Hu, 1988) and examining herbarium specimens in the Herbarium of Hunan Normal University (HNNU) and the Herbarium of Kunming Institute of Botany, Chinese Academy of Sciences (KUN), we could not find any such herbaceous *Sambucus* with pinnatipartite leaflets on compound leaves. Only one woody taxon of *Sambucus* with such leaflets had been previously reported in China as *S. sieboldiana* (Miquel) Blume ex Graebner var. *pinnatisecta* G. Y. Luo & P. H. Huang (Luo & Huang, 1987), and this

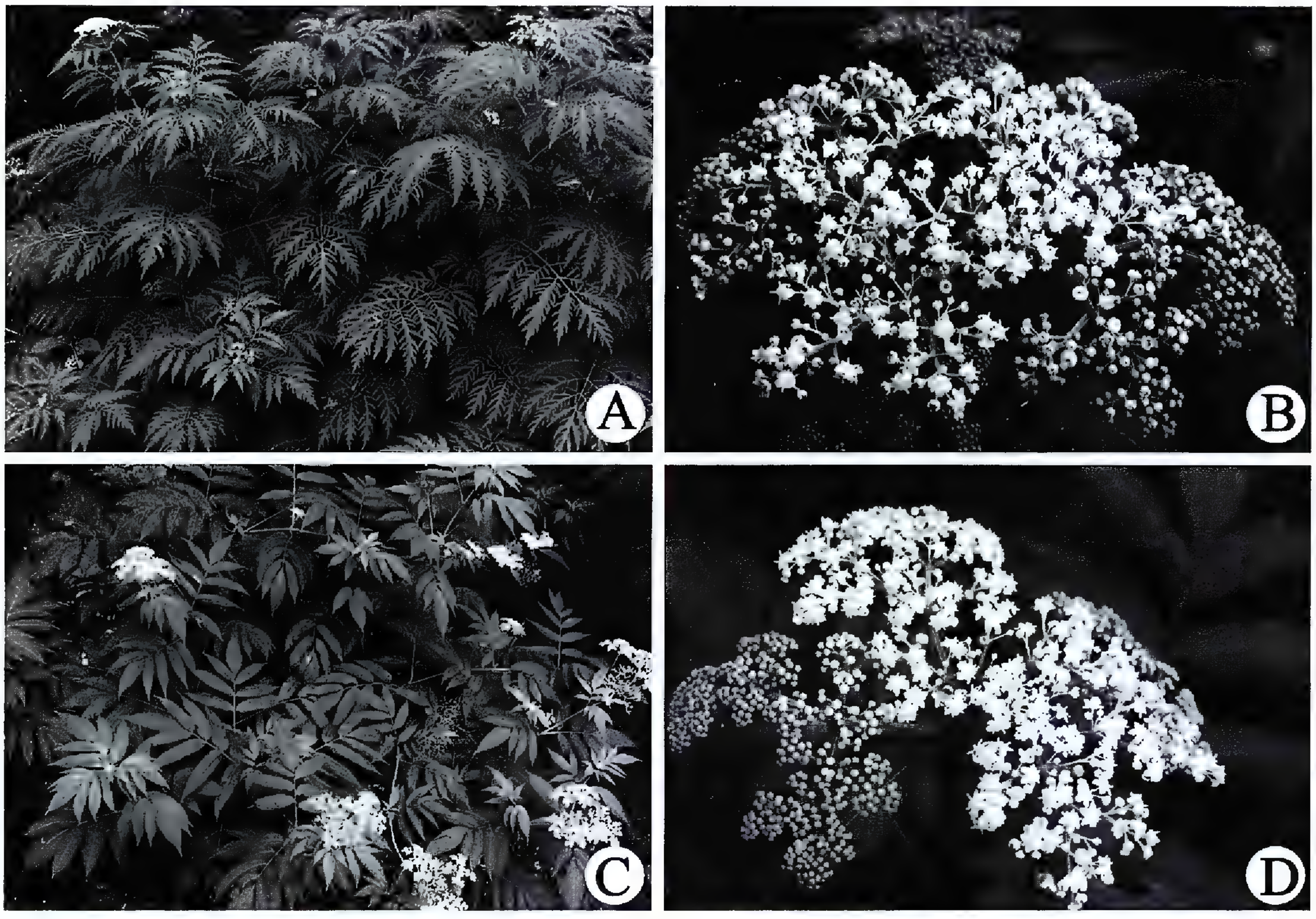

Figure 2. Habit and inflorescences for *Sambucus chinensis*. —A, B. *S. chinensis* var. *pinnatilobatus*. —C, D. *S. chinensis* var. *chinensis*.

differs by its woody stems and the lack of any cuplike sterile flowers. In 2002, we again collected specimens of this new variety with flowers or fruits from Yuelu Mountain. After morphological study and further literature searching (Samutina, 1986; Fukuoka, 1987; Bolli, 1994; Qi & Yu, 2002), as well as searches at PE and KUN, we conclude that these plants represent a new variety of *S. chinensis*. During a botanical survey we conducted in Taoyuan County (northern Hunan province) in August 2004, we found another population of this plant on Tiantishan Hill and also collected specimens.

1. Sambucus chinensis Lindley, Trans. Hort. Soc. London 6: 297. 1826. TYPE: China. Cultivated by the Horticultural Society of London, Oct. 1824, *Herb. J. Lindley s.n.* (lectotype, designated here, CGE). Figure 1.

Sambucus chinensis is widely distributed from central to southern China and is also known from Japan and Myanmar. Populations of *S. chinensis* distributed in Taiwan have been treated as another species, *S. formosana* Nakai (Li, 1978), or as a variety, *S. chinensis* var. *formosana* (Nakai) H. Hara. However, this is treated as conspecific with *S. chinensis* (Yang & Chiu, 1998; Yang et al., pers. comm.).

1a. Sambucus chinensis var. **pinnatilobatus** G. W. Hu, var. nov. TYPE: China. Hunan: Yuelu Mtn., suburb of Changsha City, 70 m, on roadside and under forest, 6 Aug. 2002 (fl), *G. W. Hu 219172* (holotype, HNNU; isotypes, KUN, MO). Figures 2A, B, and 3.

Ab *Sambuco chinensi* Lindley var. *chinensi* differt pinnis varie pinnatifidis vel pinnatipartitis vel pinnatisectis (non lobis carentibus et marginibus serratis), lobis pinnarum irregulariter pinnatilobatis vel integis.

Perennial large herb, 1–2 m tall, with horizontal rhizomes; stems erect, 0.6–1.2 cm diam., 8-ridged with white, porous pith inside. Leaves imparipinnate, opposite, 20–40 × 10–25 cm; stipules small, linear-lanceolate or often degenerated to yellow glands; leaflets 5 to 11 per leaf, opposite or nearly opposite, narrowly ovate, 6–17 × 4–7 cm, usually with short petiolules; leaflet pinnatipartite or pinnatisect with 6 to 10 pairs of lobes, the basal lobes usually with short petiolules, lobes (especially the basal ones) sometimes pinnatilobate, irregularly or sparsely serrate, sometimes one or a pair of basal lobes degenerated to yellow glands. Inflorescence a terminal compound cyme, large, 15 to 25 cm diam., flat-topped, of 900 to 1500 flowers, with 3 primary rays, leaflike bracts

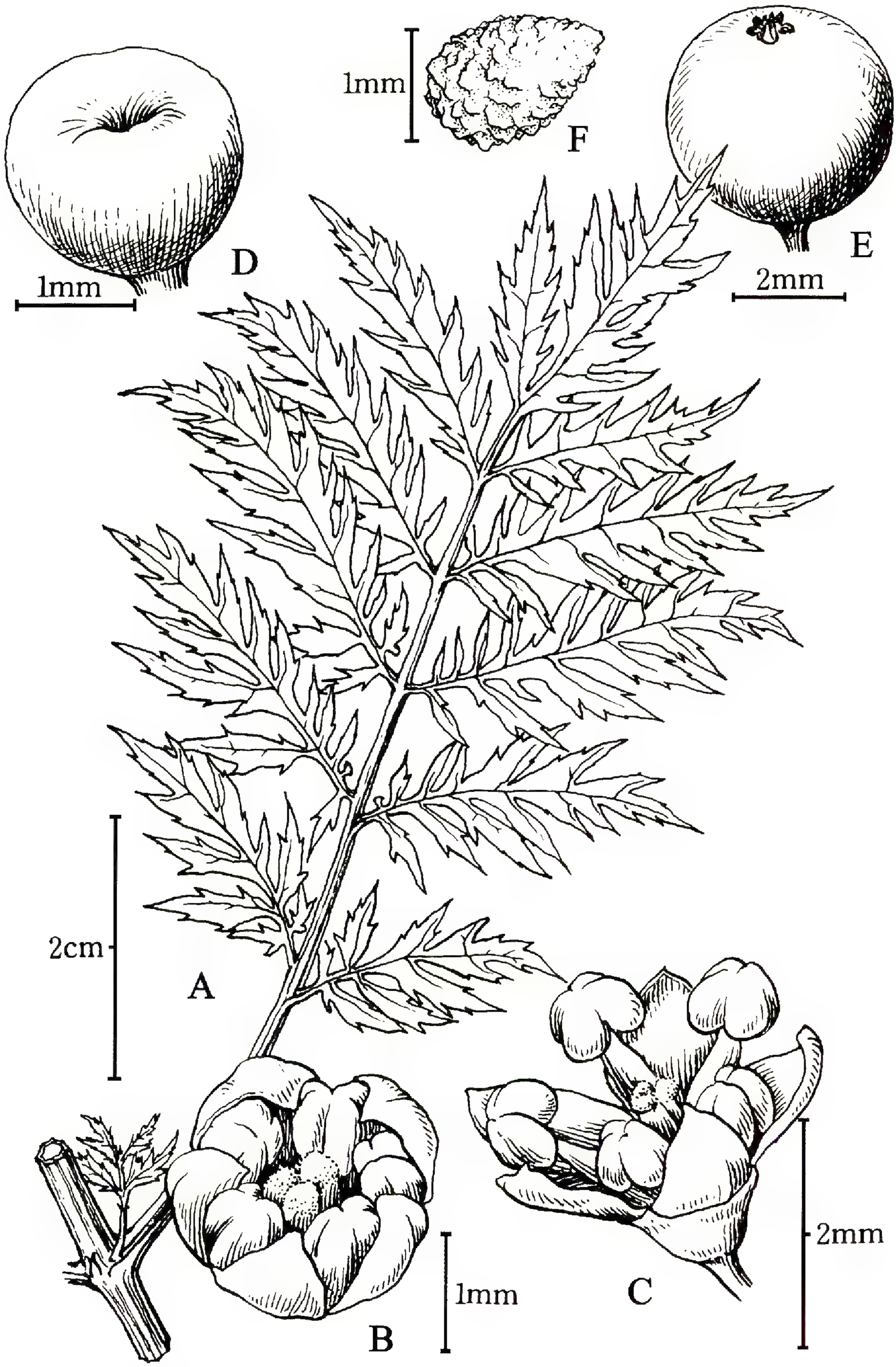

Figure 3. *Sambucus chinensis* var. *pinnatilobatus* G. W. Hu. —A. Leaf. —B. Pre-anthesal flower. —C. Anthesal flower. —D. Cuplike gland developed from sterile flower. —E. Fruit. —F. Pyrene. A–D from *G. W. Hu 219172* (HNNU); E, F from *G. W. Hu 219212* (HNNU).

presented at the base of peduncle; 30 to 50 persistent, yellow or green, cuplike sterile flowers as first flowers of the lowest cyme units. Flowers bisexual, small, 3–4 mm diam.; calyx ca. 0.5 mm, 5-lobed, lobes triangular, tube cuplike; corolla white, fused at base, ca. 1.5 mm; stamen slightly shorter than corolla, the versatile anther dark purple, slit axially, pollen yellow; ovary inferior, 3-locular; style short; stigma 3-lobed. Fruits spherical, orange-red when mature, 3.3–3.8 mm diam., with (2)3(4) pyrenes; pyrene

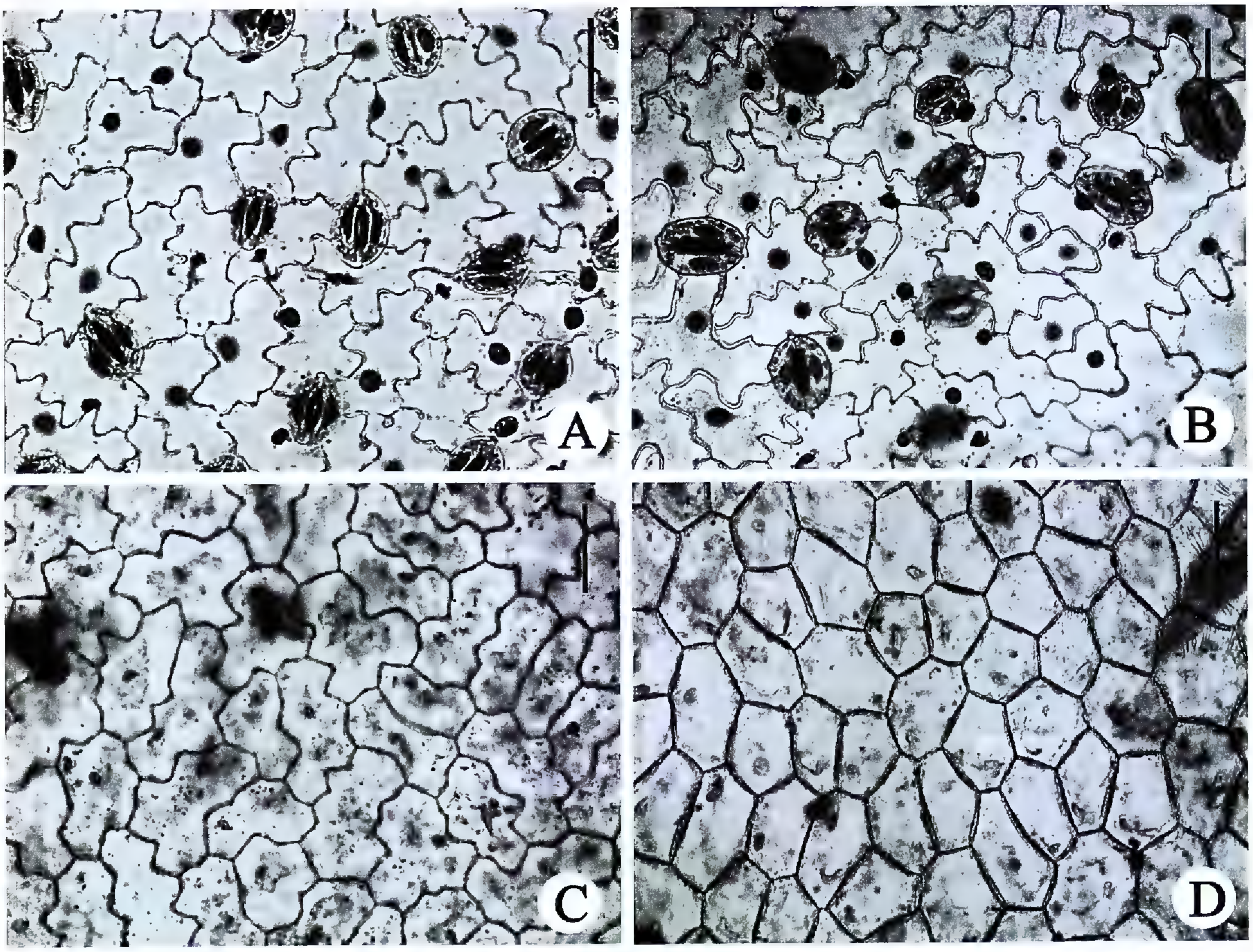

Figure 4. Epidermis characters for leaves in the two varieties of *Sambucus chinensis*. —A. Abaxial epidermis in *S. chinensis* var. *pinnatilobatus*. —B. Abaxial epidermis in *S. chinensis* var. *chinensis*. —C. Upward epidermis character of leaf in *S. chinensis* var. *pinnatilobatus*. —D. Adaxial epidermis in *S. chinensis* var. *chinensis*. Scale bars at upper right = 100 μm.

ovoid, ca. 1.7 mm, with verrucose surface. Chromosome number $2n = 36$.

Distribution. *Sambucus chinensis* var. *pinnatilobatus* is rare and has only been found on Yuelu Mountain of Changsha City and Taoyuan County in Hunan province, China. Plants intermediate between this new variety and *S. chinensis* var. *chinensis* have not been encountered.

IUCN Red List category. Following IUCN Red List criteria (IUCN, 2001), *Sambucus chinensis* var. *pinnatilobatus* can be provisionally assigned to the category of EN (Endangered) B1a and B2a (extent of occurrence less than 5000 km^2; area of occupancy less than 500 km^2; known to exist at no more than five locations and severely fragmented).

Phenology. Flowering from July to September; fruiting from August to October (pers. obs.).

Relationships. *Sambucus chinensis* var. *pinnatilobatus* distinctly differs from the autonymic variety in its leaflet shape, although the two varieties otherwise share an imparipinnate leaf arrangement. These leaflets on an odd-pinnately compound leaf are pinnatipartite or pinnatisect, and some lobes of leaflets are irregularly pinnatilobate (Fig. 2A, B). In comparison, the leaflets on the odd-pinnately compound leaf of *S. chinensis* are not lobed and have a serrate margin (Fig. 2C, D). Although the fruit and pyrene shape and color for this new variety are similar to those of the autonymic variety, their size is significantly smaller. In order to compare the size of the fruit and pyrene between the new and autonymic variety, we collected and measured mature fruits from Yuelu Mountain. The average diameter of 100 normal fresh fruits of this new variety was 3.5 mm with a range from 3.3–3.8 mm, while the average of the autonymic variety was 4.3 mm with a range from 4.0–4.8 mm. The average length of its fresh pyrenes was 1.7 mm with a range from 1.5–1.9 mm, while the average of the autonymic variety was 2.2 mm with a range from 2.1–2.5 mm. One thousand dry pyrenes of the new variety weighed 1.04 g, while that of the autonymic variety weighed 1.33 g. We also observed and compared the epidermal characters of mature leaves in both taxa under a light microscope. In 2004,

Table 1. Comparative differences between *Sambucus chinensis* var. *chinensis* and *S. chinensis* var. *pinnatilobatus*. Sample sizes for fruits equal 1000 for both varieties.

	S. chinensis var. *chinensis*	*S. chinensis* var. *pinnatilobatus*
Leaflet margin	serrate	pinnatipartite or pinnatisect and some lobes irregularly pinnatilobate
Fruit diameter (mm)	average 4.3, range 4.0–4.8	average 3.5, range 3.3–3.8
Pyrene length (mm)	average 2.2, range 2.1–2.5	average 1.7, range 1.5–1.9
Adaxial leaf epidermis	polygonal, with straight or arched anticlinal walls	irregularly shaped, with sinuous or sinuate anticlinal walls

plant material of the two varieties was collected at the type location and under similar conditions as the type collection on Yuelu Mountain. In 2007, collections of the two varieties were made from plants that had been transplanted from Changsha to a location in Kunming, Yunnan province, in 2005. We observed that the two varieties share similar epidermal cells of the abaxial leaf surface, with both having irregular-shaped epidermal cells and anomocytic stomata (Fig. 4A, B). However, their adaxial epidermis characters of leaves are distinctively different. In *S. chinensis* var. *pinnatilobatus*, the adaxial epidermal cells are irregularly shaped, and their anticlinal walls are sinuous or sinuate (Fig. 4C), while in *S. chinensis* var. *chinensis* the adaxial epidermal cells have a polygonal shape, and their anticlinal walls are straight or arched (Fig. 4D). The comparative differences between *S. chinensis* var. *chinensis* and *S. chinensis* var. *pinnatilobatus* can be found in Table 1. The chromosome report of $2n = 36$ for the new variety is in agreement with our count for the autonymic variety (Hu, pers. obs.).

In February 2004, we performed experiments in reproducing *Sambucus chinensis* var. *pinnatilobatus* with seeds and rhizomes. Our results yielded no seedlings from seeds while reproduction occurred easily with the rhizomes. In December 2005, we transplanted two rhizomes to Kunming from Changsha (each rhizome ca. 30 cm long). Each transplanted rhizome reproduced more than 10 young plants. Our surveys on Yuelu Mountain from 2001 to 2004 also did not reveal any apparent seedlings from seeds in the wild. We assume that vegetative propagation by rhizomes is the predominant reproductive strategy in *S. chinensis* var. *pinnatilobatus*. This inherent limitation of spreading only by rhizome growth may restrict the new variety's distribution.

Paratypes. CHINA. **Hunan:** Yuelu Mtn., suburb of Changsha City, 70 m, on roadside & under forest, 8 Oct. 2003 (fr), *G. W. Hu 219212* (HNNU); Taoyuan Co., Tiantishan Hill, 200 m, on roadside & in bush, 29 Aug. 2004 (fr), *G. W. Hu 219248* (HNNU).

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Two New Species of *Faramea* (Rubiaceae, Coussareeae) from Eastern Brazil

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Abstract. As part of the first author's Ph.D. studies, two new species of *Faramea* Aublet, *F. atlantica* J. G. Jardim & Zappi and *F. bicolor* J. G. Jardim & Zappi, are described from the Atlantic Forest of eastern Brazil. Both species are illustrated, and comments on their phenology, distribution, and conservation status are provided.

Resumo. Formando parte dos estudos de Doutorado do primeiro autor, duas novas espécies de *Faramea* Aublet, *F. atlantica* J. G. Jardim & Zappi e *F. bicolor* J. G. Jardim & Zappi, são descritas para a Mata Atlântica do leste do Brasil. Ambas são ilustradas, juntamente com comentários relativos à sua fenologia, distribuição e estado de conservação.

Key words: Atlantic Forest, Brazil, Coussareeae, *Faramea*, IUCN Red List, Rubiaceae.

According to Andersson (1992) and Govaerts et al. (2006), *Faramea* Aublet (Rubiaceae, tribe Coussareeae) comprises ca. 200 species distributed throughout the Neotropics from Mexico to northern Argentina. Govaerts et al. (2006) cite 123 species for Brazil, and, of those, 74 occur in the eastern part of the country, mostly in areas of coastal wet tropical or Atlantic rainforest.

The present new discoveries stem from the ongoing Ph.D. thesis by the first author, which is preceded by his M.Sc. thesis on Bahian *Faramea* (Jardim, 2003). Of the 16 species found in Bahia, two new endemic species were already treated (Jardim & Zappi, 2008). The two new species described here have a wider distribution in Brazil, and further work is necessary to define their circumscription. The conservation status was calculated from the guidelines provided by IUCN (2001).

1. Faramea atlantica J. G. Jardim & Zappi, sp. nov. TYPE: Brazil. Bahia: Itacaré, Rod. BR 101–Itacaré, vicinal para fazendas, entrada ca. 1 km da BR101. Faz. Monte Alegre (Prop. Domingos Badaró), ca. 9 km da BR, 14°19′S, 39°15′W, 5 Feb. 2004 (fl), *J. G. Jardim 4212* (holotype, CEPEC; isotype, HUEFS). Figure 1.

A *Faramea bracteata* Bentham foliis duplo minoribus atque petiolatis, bracteis pallide viridibus nec lavandulaceis differt; a *F. corymbosa* Aublet bracteis concavis semi-involucratis, stipulis paulo aristatis vel aristis usque 2 mm longis (nec 2–5 mm) ornatis, pedunculis 1- ad 3-radiatis (non 3- ad 5-radiatis), fructibus rugosis duplo majoribus distincta.

Treelets to trees, 5–12 m tall, glabrous; branches cylindric, lateral branching ± parallel. Stipules mostly deciduous from the third node, foliaceous, sheath fused at base, limb triangular to obtuse, colleters inserted internally at base of the sheath, terminal arista 0.5–2 mm, not decurrent; petiole 0.5–1 cm; lamina 6–9 × 2.5–4 cm, chartaceous, obovate to oblanceolate, apex 4–9 mm, apiculate, base cuneate, margin flat; secondary and tertiary venation visible adaxially, prominent abaxially. Inflorescences a terminal, reduced, pseudo-umbellate, 1- to 3-branched dichasium, 1- to 3-radiate peduncles flattened and thickened, 1–1.5 cm, pale green; pedicel to 1 mm; bracts corolline, 1.5–2.5 × 1.5–2 cm, cordiform, concave, enveloping the flowers only 1/3, pale green, bracteoles inconspicuous. Flowers presumably heterostylous, scented, anthesis nocturnal; calyx tube 1 mm, apex truncate to shortly toothed, colleters internally inserted at base; flowers with white, hippocrateriform corolla, 7–12 mm, lobes 5–8 mm, patent to slightly reflexed, carnose; stamens inserted in the upper 1/3 of the tube, filaments 0.5 mm, anthers 2.5–3 mm; style 3–4 mm, stigmas 1–2 mm, internally papillose, nectar disk cylindrical to annular. Fruits ca. 9 × 10 mm, oblate, sessile, pale green, pericarp wrinkled, with a shortly toothed calyx tube or displaying only the scar and the nectar disk; pyrene ca. 8 × 9 mm, oblate, wrinkled, pre-germination orifice ca. 2 × 2.5 mm, almost rounded; seed ca. 7 × 6 mm, oblate, surface slightly rugose.

Distribution and habitat. The new species is found in eastern Brazilian Atlantic Forest, in the

Figure 1. *Faramea atlantica* J. G. Jardim & Zappi. —A. Habit. —B. Stipule. —C. Reduced dichasium. —D. Gynoecium and nectar disk. —E. Open corolla showing stamens, one lobe removed. —F. Fruit. —G. Pyrene, ventral view. A–E, drawn from the holotype *Jardim 4212*; F–G, drawn from *Jardim 4157*.

states of Bahia, Espírito Santo, Minas Gerais, and Rio de Janeiro, as small trees in the understory or medium-sized trees under the canopy.

IUCN Red List category. By IUCN (2001) criteria, *Faramea atlantica* is Vulnerable (VU), B2a, b (i, iii, iv); area of occupancy ca. 1000 km², using a cell size of 200 km². This species appears to have a wide extent of occurrence and is locally common. However, despite an intensive search, it seems to be practically absent from the few forested areas remaining between the known populations. This is a case where the cell size used for determining its IUCN category (IUCN, 2001) is crucial in establishing the status of the species. If using the sliding scale principle (Justin Moat, pers. comm.), the cell size for the species would be approximately 7400 km²; this cell size, however, exceeds by far the potential vegetation (mostly coastal Atlantic forest) over which this species may occur. Three of its five populations are protected in Bahia (Reserva Biológica de Una, Faz. Piedade), Espírito Santo (Reserva Florestal da Companhia Vale do Rio Doce), and Rio de Janeiro (Reserva Biológica União). In Minas Gerais, however, it was found by Saint-Hilaire (ca. 1816–1821), at an unspecified location, and has not been collected there since.

Phenology. Flowering plants were observed in November and from January to February; fruiting plants were observed in July and December.

Etymology. The species epithet refers to the species' singular biome of the eastern Brazilian Atlantic Forest.

Vernacular name. Pau-cravo (from *D. A. Foli 170*).

Relationships. Faramea atlantica differs from other species of *Faramea* from eastern Brazil due to its concave, corolline, pale green bracts partially enveloping the flowers and by the 1- to 3-radiate, thickened peduncles that appear flattened in dry specimens. This new species belongs to the group of *F. corymbosa*, with species known from the Guianas and Peru, which also have radiate, thickened peduncles. However, in *F. corymbosa*, the peduncles are normally more than 3; the bracts are smaller, flat, and lanceolate; the stipule is long aristate (arista 2–5 cm); and the fruits are smaller and more numerous. From the same group, *F. bracteata*, from central Brazil and the Amazon, and *F. parvibractea* Steyermark, widely distributed from Venezuela to Ecuador (Taylor, 1999) and Costa Rica, are also somewhat similar, presenting corolline bracts enveloping the flowers. The first taxon has lilac bracts and subcordate, sessile leaves, twice as long as *F. atlantica*; the second one has calyptrate stipules and inflorescences with 5- to 13-radiate peduncles.

Paratypes. BRAZIL. **Bahia:** Itacaré, Rod. BR 101–Itacaré, Faz. Monte Alegre (Prop. Domingos Badaró) ca. 9 km da BR, *J. G. Jardim 4127* (CEPEC, HUEFS, K), *J. G. Jardim 4157* (CEPEC, HUEFS); Una, Rod. São José–Una, Faz. Piedade, a 9 km do entroncamento com a BR-101, *E. B. Santos & M. C. Alves 202* (CEPEC). **Espírito Santo:** Linhares, Reserva Florestal da CVRD, *D. A. Foli 170* (CVRD, NY not seen, RB, UB); Res. Flor. da CVRD, estrada da casa do guarda, *A. L. Peixoto 1062* (CVRD, RB). **Minas Gerais:** s. loc., 1816–1821, *Saint-Hilaire s.n.* (P). **Rio de Janeiro:** Rio das Ostras, Res. Biol. União, *P. P. Oliveira 625* (BHCB not seen, HUEFS).

2. Faramea bicolor J. G. Jardim & Zappi, sp. nov. TYPE: Brazil. Bahia: Uruçuca, Rod. Serra Grande–Uruçuca ca. 14 km W, Parque Est. Serra do Conduru, 14°28.83′S, 39°06.33′W, Serra do Conduru, 18 Dec. 2003, *J. G. Jardim, A. M. Amorim, A. M. Z. Martini, S. C. de Sant'Ana & J. L. da Paixão 4169* (holotype, CEPEC; isotypes, HUEFS, K, MO, NY, RB, SPF). Figure 2.

Ab omnibus ceteris *Farameae* Aublet speciebus vaginis limbi stipularis connatis atque limbo ramos involvente, stipulis breviter vel haud aristatis, foliis coriaceis, ad marginem valde revolutis, corollis bicoloribus tubo albo atque lobis caeruleis distincta.

Treelets, 3–6 m tall, glabrous; branches cylindric, lateral branching ± parallel. Stipule usually persistent, foliaceous, sheath connate, limb obtuse to truncate, enveloping the branches, colleters scattered internally throughout the lamina, with a reduced arista ca. 1 mm or absent, not decurrent; petiole 1–2 cm; lamina 14–18(25) × 5–7(10) cm, coriaceous, elliptic, apex 7–8 cm, acuminate, base cuneate, margin revolute, secondary and tertiary venation visible abaxially and adaxially, young leaves blue-toned. Inflorescence terminal, thyrsoid, peduncle 3–5 cm, cylindric, profusely branched, white to lilac; pedicel 1–4 mm; foliaceous bracts ca. 7–10 × 4–6 cm, obovate to elliptic, flat, bracteoles inconspicuous. Flowers presumably heterostylous, scented, anthesis diurnal; calyx tube ca. 1 mm, apex shortly toothed, colleters inserted internally, halfway up the calyx tube; pin flowers with white corolla tube, margin of corolla lobes blue; corolla hippocrateriform, 6–7 mm, lobes 2–3 mm, slightly reflexed, carnose; stamens inserted halfway up the tube, filaments 4–5 mm, anthers 2.5–3.5 mm; style 4–5 mm, stigmas 0.5–1 mm, internally papillose, nectar disk cylindrical; thrum flowers not observed. Fruit 10–12 × 8–10 mm, oblate, pedicel 1–3 mm, with shortly toothed calyx tube or displaying only the scar and the nectar disk, pericarp green turning black when ripe, smooth; pyrene 10–12 × 7–8 mm, oblate,

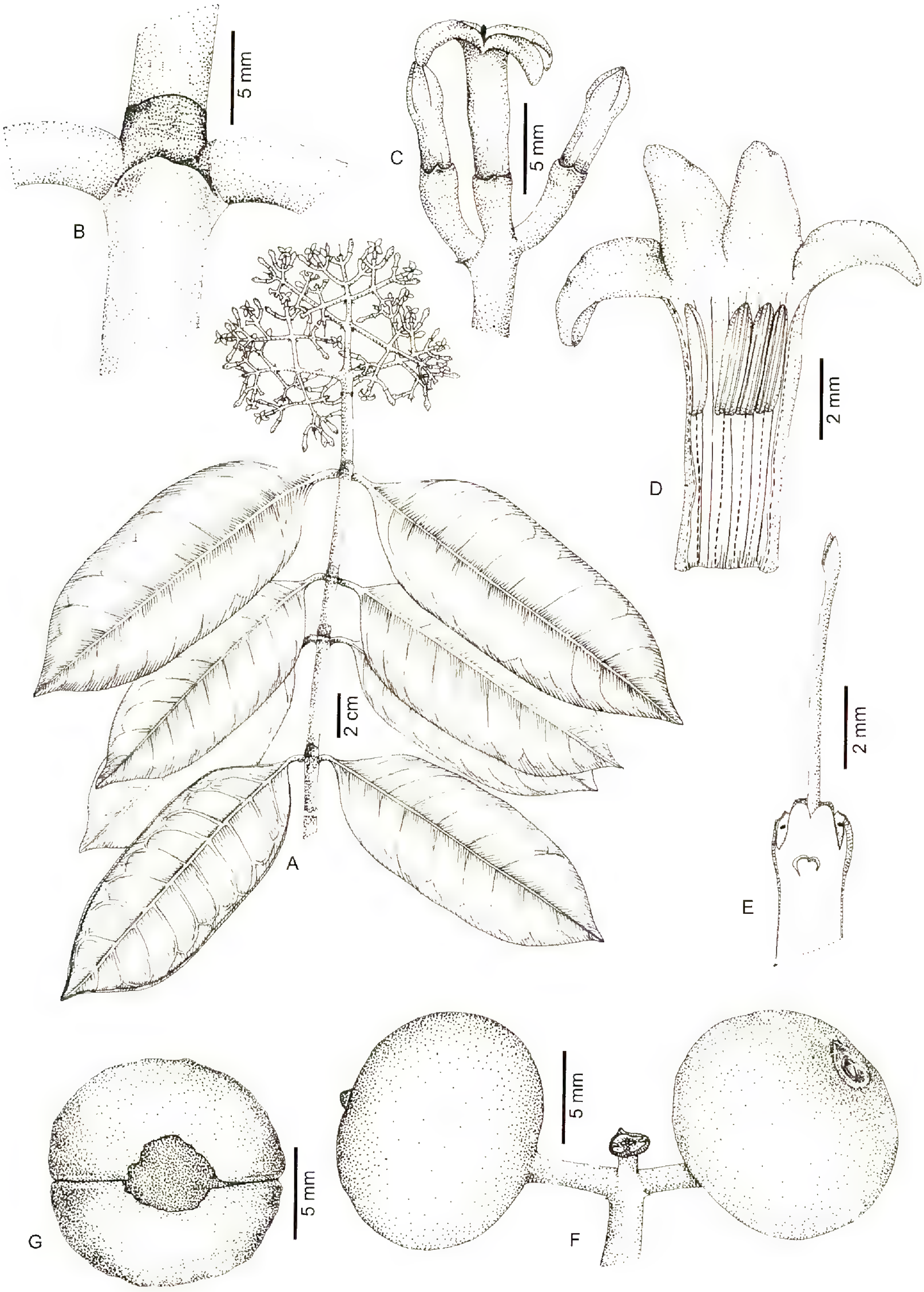

Figure 2. *Faramea bicolor* J. G. Jardim & Zappi. —A. Habit. —B. Stipule. —C. Detail of inflorescence. —D. Open corolla, showing stamens. —E. Longitudinal section of calyx showing nectar disk and style. —F. Fruits. —G. Pyrene, ventral view. A–E, drawn from the holotype *Jardim et al. 4169*; F, drawn from *Mori 11764*; G, drawn from *Fiaschi et al. 2390*.

slightly wrinkled, longitudinally sulcate, pre-germination orifice ca. 3 × 5 mm, almost rounded; seed ca. 7 × 6 mm, oblate, testa smooth, longitudinally sulcate.

Distribution and habitat. *Faramea bicolor* is found in southeastern Bahia, in Brazilian Atlantic rainforest, between 400 and 800 m, as understory shrubs to small trees.

IUCN Red List category. By IUCN (2001) criteria, *Faramea bicolor* is Vulnerable (VU), B2a, b(i, ii, iii); extension of occurrence estimated ca. 8766 km^2. This species is only known from three conservation areas in Bahia, from the Estação Ecológica Estadual de Wenceslau Guimarães, Parque Estadual Serra do Conduru, and the Reserva Particular do Patrimônio Natural Jequitibá/Sapucaia (Fazenda Água Boa), in Maraú.

Phenology. Flowering plants were observed between December and February; fruiting plants were observed from February to August.

Etymology. The specific epithet of this new species refers to the graceful, bicolored flowers, with contrasting blue and white lobes.

Vernacular name. Unknown.

Relationships. Faramea bicolor differs from other known species of *Faramea* by its reduced or absent stipular arista; the peculiar limb enveloping the branches; leaves with coriaceous texture, strongly revolute margin, and very prominent secondary venation; and bicolored, contrasting blue and white flowers.

Despite the fact that the morphology of the stipules resembles the closely related genus *Coussarea* Aublet, the characters that place *Faramea bicolor* within *Faramea* are the blue coloration in its young leaves, corolla, and fruits (this color is totally absent from species of *Coussarea*), as well as seeds with an excavated base and lateral embryo, while in *Coussarea* the seed base is not excavated and the embryo is basal. The new species resembles *F. martiana* Müller Argoviensis because of its terminal, many-flowered inflorescence and elliptic leaves, but can be easily distinguished by its petiolate leaves with revolute margins (vs. leaves generally sessile, margin flat), the connate stipular limb enveloping the branches, with the arista reduced or absent (vs. the stipular limb connate only at base and not enveloping the branches, with the arista 3–7 mm long), and the striking bicolored corolla (vs. the corolla entirely violet).

Paratypes. BRAZIL. **Bahia:** Maraú, Faz. Água Boa, BR 030 a 22 km E de Ubaitaba, *S. A. Mori 12744* (CEPEC, MO, NY not seen); Una, Ribeirão da Caveira, Serra do Javi, ramal com entrada no Km 11 da Rod. São José–Una, ca. 6 km S da entrada, *T. S. Santos & E. Judziewicz 3994* (CEPEC, NY not seen); Uruçuca, est. Serra Grande–Uruçuca, Serra do Conduru, Mata da Torre de Celular, *P. Fiaschi, A. M. Amorim, J. G. Jardim, J. L. Paixão & S. C. Sant'Ana 2390* (CEPEC, SPF not seen); nova estrada que liga Uruçuca a Serra Grande, *S. A. Mori 11748* (CEPEC, NY not seen), *S. A. Mori 11764* (CEPEC, UB, MO, NY not seen); Wenceslau Guimarães, Forest of Faz. Boa Esperança near Res. Estadual Wenceslau Guimarães, 8 km above Rio Vermelho, 2 km above jct. with rd. to Taquara, *W. W. Thomas, A. M. de Carvalho, A. M. Amorim, T. S. Santos, S. C. Sant'Ana & J. G. Jardim 9383* (CEPEC, MO, NY not seen); Est. Ecol. Est. Nova Esperança, *A. M. Amorim, J. G. Jardim, C. van den Berg, J. L. Paixão, S. C. Sant'Ana, & A. B. Rodrigues 5092* (CEPEC).

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Goodyera dongchenii var. *gongligongensis* (Orchidaceae), a New Variety from Yunnan, China

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ABSTRACT. *Goodyera dongchenii* var. *gongligongensis* X. H. Jin & S. C. Chen (Orchidaceae) is described from Yunnan, China. It differs from the typical variety by having strongly white-reticulate leaves and lip up to 1 cm long.

Key words: China, *Goodyera*, IUCN Red List, Orchidaceae.

Goodyera R. Brown (Orchidaceae) consists of about 80 species distributed from the northern temperate regions to Mexico, Australia, and southeastern Asia (Pridgeon et al., 2003). This genus is characterized by a creeping rhizome, terminal inflorescence with resupinate flowers, lip saccate or hollow usually with hairs inside, short column with one stigma, and sectile pollinia with distinct stipes (Pridgeon et al., 2003). There are about 30 species in China, most of which are used as medicine by local people (Lang, 1999). During our botanical trips to the Dulongjiang River Valley in September 2005 and August 2006, a new variety was found. It was first identified as *G. dongchenii* S. Z. Lucksom, a species restricted to Sikkim and not recorded in China (Lang, 1999; Pearce & Cribb, 2002). *Goodyera dongchenii* is a distinct species that can be distinguished from other Chinese species of *Goodyera* by its leaves distant along the stem, inflorescence not recurred, white flowers, and lip bearing two thick lamellae. However, the new variety has leaves that are strongly white-reticulate and a longer lip. Owing to the taxonomical significance of the colored reticulation on the leaf surface in *Goodyera*, we treat it here as a new variety.

Goodyera dongchenii S. Z. Lucksom, J. Indian Bot. Soc. 72: 191. 1993. TYPE: India. Sikkim: Fambong Lho Wildlife Sanctuary, *S. Z. Lucksom 210* (holotype, CAL not seen).

Goodyera dongchenii var. **gongligongensis** X. H. Jin & S. C. Chen, var. nov. TYPE: China. Yunnan: Gongshan Co., Dulong Distr., in forest, 2400 m, 3 Sep. 2005 (fl), *X. H. Jin 7953* (holotype, PE; isotype, PE).

A *Goodyera dongchenii* var. *dongchenii* foliis valde alboreticulatis, labio corollino longiore, usque ad 1 cm longo (non 0.7 cm) differt.

Terrestrial herb; stems 10 cm, 2.5 mm diam. Leaves 2 or 3, ovate, strongly white-reticulate on adaxial surface, 2.5–3.5 × 1.5–2.3 cm; petiole ca. 0.3 cm, basally sheathed and amplexicaul. Inflorescence 8 cm, 8- to 10-flowered, secund; rachis pubescent; sterile bracts 3, lanceolate, ca. 1 × 0.3 cm; floral bracts lanceolate, pubescent, ca. 1.5 × 0.3 cm. Flowers white, slightly open aspect; pedicel with inferior ovary ca. 1 cm long, puberulent; sepals densely hairy; dorsal sepal narrowly triangular, 3-veined, concave, ca. 1 × 0.6 cm, tip curved upward; lateral sepals ovate, acuminate, 3-veined, ca. 1 × 0.6 cm; petals rhombic, 3-veined, ca. 0.9 × 0.4 cm, acuminate; corolla lip ca. 1 cm, basally fleshy, hypochil saccate, setose inside; epichil lanceolate, ca. 0.7 × 0.2 cm, with 2 fleshy ridges ranging from base to tip; column ca. 2 mm, robust; rostellum bifid, ca. 5 mm; anther 2-celled, anther cap beaked, ca. 3 mm; pollinia 4, in 2 pairs, clavate.

Distribution and habitat. This reticulate-leaved variety, discovered in the Dulongjiang River Valley in forest at elevations between 2200 and 2700 m, was observed as common in this area. During our two-week stay in this area, five clusters with flowering plants at three separate sites were discovered. These three sites were at distances of 20 km from each other.

IUCN Red List category. *Goodyera dongchenii* var. *gongligongensis* is endemic in the Dulongjiang Valley

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and known from only three separate localities. Recently, the Dulongjiang Valley has been greatly affected by tourism. Therefore, the new variety can be considered EN (Endangered) according to IUCN Red List criterion B1ab(iii) because of its known area of occupancy and continuing decline of habitat (IUCN, 2001).

Relationships. The new variety differs from *Goodyera dongchenii* var. *dongchenii* by having strongly white-reticulate leaves and the corolla lip about 1 cm long. The leaves of the typical variety lack these colored reticulations, and its floral lip is about 0.7 cm long.

Paratype. CHINA. **Yunnan:** Gongshan Co., Dulong Distr., in forest, 2700 m, 18 Aug. 2006 (fl), *X. H. Jin 8389* (MO).

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Two New Species of *Psidium* (Myrtaceae) from Bahia, Brazil

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Abstract. Two new species of *Psidium* L. (Myrtaceae) from Bahia, Brazil, are described and illustrated. Both are compared with *P. cattleyanum* Sabine, a possible close relative and a species with which they might be confused. Both species differ from *P. cattleyanum* because of their longer peduncles (2–8(–13) mm in *P. cattleyanum*, 10–22 mm in *P. ganevii* Landrum & Funch, and 12–34 mm in *P. bahianum* Landrum & Funch), and because the tears in the calyx do not, or scarcely, penetrate the staminal ring (in *P. cattleyanum* they deeply penetrate the ring). The leaf length of *P. cattleyanum* (to 10 cm) is intermediate between *P. ganevii* (to 4 cm) and *P. bahianum* (to 14 cm). The leaves of *P. bahianum* differ from *P. cattleyanum* in usually being ovate (not obovate), arching along the midvein, and often enfolding longitudinally; its leaf apices are usually acuminate and, when the leaf is pressed flat, often turn to one side. *Psidium ganevii* differs also from *P. cattleyanum* in often having emarginated apices; the leaves are often widest at the middle (not above the middle).

Key words: Bahia, Brazil, IUCN Red List, Myrtaceae, *Psidium*.

The Myrtaceae are an abundant, sometimes dominant, family in the Atlantic Coastal Forest of Brazil (Mori et al., 1983). It is probable that many species remain to be described scientifically, and the state of Bahia appears to be especially rich in new Myrtaceae. In preparing a treatment of *Psidium* L. for Bahia, we have discovered two species that we here describe as new. In reviewing type specimens over the past several years, we have not found any that match these new species. Apparently, A. P. de Candolle (1828), Cambessèdes (1833), and Berg (1857–1859) had little material from Bahia when preparing their treatments of Myrtaceae. We found one specimen of Blanchet of *P. bahianum* Landrum & Funch at W that might have been available to these earlier investigators, but there is no evidence that it was ever used to describe a new species.

Psidium is a genus of at least 50 species and perhaps as many as 100 (McVaugh, 1968), ranging from Mexico and the Caribbean to Argentina and Uruguay. The distinguishing characters of *Psidium* are discussed in Landrum (2003) and in Landrum and Sharp (1989) and are flowers 5-merous with multiovulate locules; placenta often peltate; seed coat rough or dull, not lustrous, covered with a pulpy layer when wet; and the hard portion of seed coat (5 to)8 to 30 cells thick at the narrowest point, with the cells thick-walled, elongate, and overlapping.

1. Psidium bahianum Landrum & Funch, sp. nov. TYPE: Brazil. Bahia: Alagoinhas, Campus II/UNEB, Rod. Alagoinhas–Salvador, Km 03, 12°10′68″S, 38°24′81″W, 11 Oct. 2001 (buds), *N. G. Jesus 1384* (holotype, HUEFS, photos at ASU, MO). Figure 1G–J.

Haec species *Psidio cattleyano* Sabine primo aspectu similis, sed quoad altitudinem maiore, foliis maioribus plerumque ovatis, floribus saepe in surculis bracteatis differt.

Arbor usque 25 m; folia nitida, ovata, lanceolata vel elliptica, 3.5–14 × 3.2–6.5 cm, 1–2.3-plo longiora quam latiora, arcuata; peduculus 12–34 mm; calyx ante anthesin clausus, sub anthesi irregulariter fissus.

Tree up to 25 m high, essentially glabrous except for sparsely to densely puberulent inner surface of calyx and disk; young twigs reddish brown to gray, becoming only slightly rough with age. *Leaves* ovate, lanceolate, or elliptic, 3.5–14 × 3.2–6.5 cm, 1–2.3× as long as wide; apex usually acuminate, less often acute or obtuse, often turned to one side in pressing; base obtuse or rounded; petiole 2–8 mm long, to ca. 3 mm thick, unchanneled or slightly channeled distally; midvein nearly flat to raised slightly adaxially, prominent abaxially; venation brochidodromous, the lateral veins weak, 7 to 12 pairs, a weaker marginal vein arching between lateral veins to within 1–4 mm of the margin, the weaker tertiary veins dendritic; blades coriaceous, drying gray-green to dark reddish brown, often lustrous

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adaxially. *Flower buds* pyriform, 4–8 mm, glabrous, borne in axillary bracteate shoots of ca. 3 nodes and with a rachis 1.2–2.5 cm, or solitary in leaf axils or at leafless nodes, the shoots occasionally terminating in a leafy node; peduncles uniflorous, 12–34 × 1–2 mm; bracteoles narrowly triangular, ca. 1.5 mm, glabrous or ciliate. *Calyx* closed or with a small apical pore, tearing irregularly at anthesis, the tears not (or scarcely) penetrating the staminal ring; mature petals unknown; hypanthium 2–4 mm; stamens ca. 140, 6–9 mm; anthers ca. 1 mm, with ca. 1 gland in the connective; style 6–8 mm; ovary 3-locular; 28 to 33 ovules per locule. *Fruit* subglobose, 15–30 mm; seeds 15 to 20, 3–4 mm, not angular.

Distribution, habitat, and IUCN Red List category. *Psidium bahianum* is found in restinga and forests at less than 200 m elevation and is apparently endemic to eastern Bahia, Brazil. The species should be considered DD (Data Deficient) according to IUCN Red List criteria (IUCN, 2001) because it is known from very few localities in the generally severely altered Atlantic Coastal Forest region. More information about the numbers of individuals and the extent of the habitat is desirable. Local botanists are encouraged to investigate.

Phenology. Flowering October to December, with fruits from December to February (rarely September).

Relationships. *Psidium bahianum* is distinguished by being essentially glabrous and by its large leaves (to 14 cm long) that are coriaceous and lustrous, are generally ovate in shape, and arch along their midveins. The leaf apices are usually acuminate and, when the leaf is pressed flat, often turn to one side. The blade is enfolded longitudinally and often is pressed folded and hiding the adaxial surface. The calyx in the flower bud may be completely closed or have a terminal pore opening and is puberulent within. *Psidium bahianum* is contrasted in the key couplet below with the widespread, common, and weedy species *P. cattleyanum* Sabine, a native of the Brazilian Atlantic Coastal Forest.

1a. Tree to 25 m; leaves mainly widest somewhat below the middle, the blades arching longitudinally; peduncles 12–34 mm long, often borne in bracteate shoots; tears in calyx not or scarcely penetrating the staminal ring . . . . . *P. bahianum*
1b. Tree to 10 m; leaves mainly widest above the middle, not normally arching; peduncles 2–8(–13) mm long, solitary; tears in calyx usually penetrating deeply into the staminal ring. . . . . *P. cattleyanum*

In having bracteate shoots and an elliptic to lanceolate leaf shape, *Psidium bahianum* is similar to *P. myrtoides* O. Berg, but differs from that species in having a closed or nearly closed calyx and peduncles 12–34 mm long (in *P. myrtoides* the calyx is open and the peduncles only 2–9 mm long).

Paratypes. BRAZIL. **Bahia:** N de Alagoinhas, 12°2′3″S, 38°18′45″W, 14 Feb. 1980, *A. Araujo 209* (HRB, RB); Entre Rios, Subauma, ponto 5, 12°13′S, 37°52′W, 8 Dec. 1982, *A. Araujo, G. Pinto, J. Arouck, H. Bautista et al. 371* (CEPEC, HRB); Conde, Fazenda do Bu, Mata do Fundão, 12°0′51″S, 37°43′2″W, 8 Nov. 1995, *M. C. Ferreira & T. Jost 831* (HUEFS); Entre Rios, Restinga de Massarandupió, 12°19′45″S, 37°52′8″W, 12 Jan. 2001, *M. R. Fonseca & M. da C. R. Silva 88* (HUEFS); Km 50 da Rod. Ilhéus–Una, Est. da EMBRAPA (EDJAB), 16 Sep. 1993, *J. G. Jardim, S. C. Sant'Ana, A. Amorim, E. B. Santos & A. Gois Neto 295* (SP); Maraú, ca. 7 km N do Povoado de Saquaira, Peninsula de Maraú, 13°59′10″S, 38°57′02″W, 2 Feb. 2000, *J. G. Jardim, W. W. Thomas, S. C. Sant'Ana, M. V. Alves, E. A. Rocha & B. M. Torke 2626* (F); Alagoinhas, Campus II/UNEB, 12°10′6″S, 38°24′8″W, 16 Jan. 2001, *N. G. Jesus 496* (HUEFS); Entre Rios, RPPN Faz Lontra/Saudade, 12°54′55″S, 40°12′56″W, 16 Jan. 2000, *N. G. Jesus 1103* (HUEFS); Campus II/UNEB, Rod. Alagoinhas Salvador, Km 3, 12°10′6″S, 38°24′8″W, 24 Oct. 2001, *N. G. Jesus 1389* (HUEFS); DCET/Campus II–Herbário HUNEBRA, 1 Nov. 1998, *N. G. Jesus, M. D. R. Orge, A. M. S. Jorge & J. B. Santos 617* (HUEFS); entre Alagoinhas e Entre Rios, 14 Feb. 1980, *G. Pinto 186* (HRB).

2. Psidium ganevii Landrum & Funch, sp. nov. TYPE: Brazil. Bahia: Mun. de Abaíra, Engenho de Baixo-Catolés, próximo ao Rio do Ribeirão, 13°18′S, 41°49′W, 950 m, carrasco com solo arenoso, 20 Nov. 1992 (fl), *Wilson Ganev 1518* (holotype, HUEFS, photos at ASU, MO). Figure 1A–F.

Haec species *Psidio cattleyano* Sabine primo aspectu similis, sed foliis brevioribus, pedunculis longioribus, apicibus saepe emarginatis, petiolis brevioribus differt.

Frutex usque 3 m; folia obovata, oblanceolata, vel elliptica, 1.5–4(–5.3) × 0.8–3 cm, 1.1–2.5-plo longiora quam latiora; pedunculus 10–22 mm; calyx ante anthesin poro amplo terminali, sub anthesi irregulariter fissus.

Shrub to ca. 3 m high, minutely puberulent on young twigs, leaf bases, and some floral surfaces, otherwise glabrous; hairs whitish to reddish brown, to ca. 0.1 mm, erect; young twigs moderately puberulent, the hairs persisting until juvenile bark falls, the young bark reddish brown to gray, falling in strip-like scales, the older twigs gray, somewhat rough with longitudinal ridges and cracks. *Leaves* obovate, oblanceolate, or elliptic, 1.5–4(–5.3) × 0.8–3 cm, 1.1–2.5× as long as wide, the margins revolute; apex rounded to obtuse, often emarginate; base acute, cuneate, acuminate, or rounded; petiole channeled, puberulent, 1–3 × 1–1.5 mm; midvein flat to slightly impressed adaxially, moderately prominent abaxially; venation brochidodromous, the lateral veins usually obscure, to ca. 9 pairs scarcely visible, leaving midvein at ca. 45°; marginal vein indistinct, apparently closely following the margin; blades coriaceous, densely glandular, with

Figure 1. A–F. *Psidium ganevii* Landrum & Funch. —A. Twig with leaves and old flower. —B. Portion of a bracteate shoot inflorescence. —C. Flower bud with tears developing in calyx. —D. Flower after petals and stamens have fallen. —E. Twig with leaves and fruit. —F. Opened fruit and seed. G–J. *Psidium bahianum* Landrum & Funch. —G. Twig with leaves and bracteate shoot inflorescences, one of which terminates in a pair of immature leaves. —H. Closed flower bud, showing small terminal pore. —I. Twig showing arching leaves and inflorescence after anthesis. —J. Open flower with petals having fallen. A, drawn from *Miranda 90* (ASU); B–D, *Ganev 1518* (HUEFS, holotype); E–F, *França et al. 2834* (ASU); G–H, *Jesus 1384* (HUEFS, holotype); I–J, *Jesus 1389* (HUEFS). Drawn by Bobbi Angell. Scale for C applies to D; scale for E and G applies to A and I.

raised glands abaxially and adaxially, drying reddish brown to yellowish tan, lighter abaxially; adaxial surface often tinged with gray, often somewhat lustrous. *Flower buds* pyriform to campanulate, 7–8 mm, borne in the axils of leaves or bracts; peduncles 10–22 × 1–1.2 mm, somewhat flattened, glabrous to sparsely puberulent; bracteoles linear, 1.5–2 mm, sparsely puberulent. *Calyx* bowl-like, fused beyond ovary summit for 3–4 mm, open distally as a large apical pore, the pore margin merely sinuate, without notable lobes, the tubular portion of the calyx tearing irregularly 3–4 mm to staminal ring at anthesis in 4 to 5 lobes; outer surface glabrous or essentially so, the inner surface densely puberulent; mature petals unknown; hypanthium funnel-shaped, 4–5 mm, glabrous or essentially so; disk ca. 5 mm across after anthesis, densely puberulent; stamens over 100, 8–10 mm long; anthers 0.5–0.7 mm, with 1 terminal gland in the connective; style 8–10 mm, glabrous; ovary 3-locular; ovules 12 to 14 per locule, the placenta subpeltate. *Fruit* glabrous, globose, 1.5–2.5 cm; seeds probably fewer than 10, ca. 7 mm.

Distribution, habitat, and IUCN Red List category. *Psidium ganevii* is found in caatinga and savanna vegetation, in sandy soils, at 800–1200 m elevation; it is endemic to central Bahia. The species should be considered DD (Data Deficient) according to IUCN Red List criteria (IUCN, 2001) because it is known from very few localities.

Phenology. Collected in flower in November, probably continuing to January based on specimen with young fruits; collected in fruit in February, April, May, and August.

Relationships. *Psidium ganevii* is distinguished by being minutely puberulent on young twigs, leaf bases, and some floral surfaces, but otherwise glabrous, and by its small leaves (rarely over 4 cm long) that are densely glandular abaxially and adaxially and that commonly have emarginated apices. The bowl-like calyx has a large apical pore and is densely puberulent within. *Psidium ganevii* is contrasted in the key couplet below with *P. cattleyanum*.

1a. Leaves usually 2–4 cm long, mainly widest near middle; leaf apices often emarginate, not acuminate; peduncles 10–22 mm long, about 1/2 as long as leaves or longer; petiole 1–3 mm long; tears in calyx usually not penetrating staminal ring. . . . . *P. ganevii*

1b. Leaves mainly over 4 cm long, mainly widest above the middle; leaf apices not emarginate, often acuminate; peduncles 2–8(–13) mm long, usually much less than 1/2 as long as leaves; petiole 2–14 mm long; tears in calyx usually penetrating deeply into staminal ring . . . . . *P. cattleyanum*

Paratypes. Brazil. **Bahia:** Chapada Diamantina, Mun. Seabra, BR-142, 4 km de Seabra (estrada Seabra–Barreira), 12°25′S, 41°48′W, 6 Aug. 1996, *F. S. Araujo & F. R. Martins 1266* (SP); Morro de Chapéu, Cachoeira do Rio Ferro Doido, trilha que liga a estrada do feijão ao vale, 11°37′45″S, 40°59′26″W, 30 Apr. 1999, *F. França, E. Melo & B. Marques da Silva 2767* (ASU, HUEFS); 11 km W de Morro do Chapéu, 11°13′15″S, 41°15′31″W, 2 May 1999, *F. França, E. Melo & B. Marques da Silva 2834* (ASU, HUEFS); ca. 26 km N of Seabra, rd. to Água de Rega, near Rio Riachão, Serra da Água de Rega, 23 Feb. 1971, *H. S. Irwin, R. M. Harley & G. L. Smith. 30790* (NY); Morrão, 11°35′28″S, 41°12′24″W, 7 Feb. 1999, *E. B. Miranda 90* (ASU, HUEFS); Catolés, Encosta da Serra da Tromba, 13°17′10″S, 41°48′0″W, 4 May 2000, *E. B. Miranda, K. Leite, C. Correia & B. Marques da Silva 447* (ASU, HUEFS).

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New Combinations in the Pleurothallidinae (Orchidaceae) from the Southern Cone Region of South America

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ABSTRACT. Seven new combinations of species previously treated in *Pleurothallis* R. Brown (Orchidaceae, Pleurothallidinae) and found in the southernmost region of South America (the Southern Cone) are proposed: *Anathallis bertoniensis* (Hauman) Luer, *A. kleinii* (Pabst) Luer, *A. liparanges* (Reichenbach f.) Luer, *A. rigidula* (Cogniaux) Luer, *Pabstiella dryadum* (Schlechter) Luer, *P. pellifeloidis* (Barbosa Rodrigues) Luer, and *P. piraquarensis* (Hoehne) Luer. Lectotypes are selected for the following names: *A. rigidula* and *P. pellifeloidis*.

Key words: *Anathallis*, Argentina, Brazil, Orchidaceae, *Pabstiella*, Paraguay, Pleurothallidinae, *Pleurothallis*.

In the forthcoming checklist of species from the Southern Cone area of South America (Zuloaga et al., 2008), seven collections were identified as belonging to a polyphyletic *Pleurothallis* R. Brown as well as the affined *Lepanthes* Swartz (Luer, 1986, 1999, 2004, 2006, 2007; Pridgeon & Chase, 2001). These seven species are separated here into two genera within the Orchidaceae. Unfortunately, the DNA of very few of the Pleurothallidinae have been sequenced, so the genera to which many species are assigned rely entirely on morphology, which is, nevertheless, the final product of their DNA. Some changes can be expected in the future as advanced DNA sequencing becomes available.

None of Barbosa Rodrigues' collections exist today. His original illustrations deposited in the Rio de Janeiro Botanical Garden (RB), designated here and elsewhere as lectotype, have been republished (Sprunger et al., 1996).

Anathallis Barbosa Rodrigues is distinguished by leaves that are petiolate or narrowly cuneate at the base and with one or more racemes produced apically at the base of the leaf or the petiole. The flowers are relatively membranous; the lateral sepals are mostly free and spreading; the petals are variable and membranous; and the lip is usually oblong with the margins more or less erect or uncommonly lobed below the middle, and with various longitudinal calli.

Pabstiella Brieger & Senghas is presently a polymorphic genus that will probably prove to be polyphyletic as well when DNA sequencing includes more than one region. Most plants are small with a short ramicaul from which one or more racemes are produced apically. Minutely ciliated sheaths of the ramicauls seem to occur at random. The sepals are variable, but the lateral sepals are mostly connate to some degree, often forming a spur at the base with the column-foot; the petals are more or less obovate and membranous; and the lip varies greatly from long-unguiculate to truncate at the base. There is a gradual continuum from one extreme to the other.

ANATHALLIS

Anathallis bertoniensis (Hauman) Luer, comb. nov.

Basionym: *Pleurothallis bertoniensis* Hauman, Anales Soc. Ci. Argent. 90: 144. 1920. *Stelis bertoniensis* (Hauman) Pridgeon & M. W. Chase, Lindleyana 16: 261. 2001. *Specklinia bertoniensis* (Hauman) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 259. 2004. TYPE: Paraguay. Puerto Bertoni, Jan. 1918, flowered in cultivation in Buenos Aires, Apr. 1930, *L. Hauman s.n.* (holotype, BRLU).

Anathallis kleinii (Pabst) Luer, comb. nov. Basionym: *Pleurothallis kleinii* Pabst, Bradea 1: 179. 1972. *Specklinia kleinii* (Pabst) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 261. 2004. *Panmorphia kleinii* (Pabst) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 105: 177. 2006. TYPE: Brazil. Santa Catarina: Ilha de Santa Catarina, Pântano do Sul, 20 Oct. 1970, *R. M. Klein & A. Bresolin 8795* (holotype, FLOR; isotype, HB 57412).

Anathallis liparanges (Reichenbach f.) Luer, comb. nov. Basionym: *Pleurothallis liparanges* Reichenbach f., Gard. Chron. 1: 532. 1885. *Specklinia liparanges* (Reichenbach f.) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 261. 2004. TYPE: Brazil. S. loc., obtained from G. M. Binot, cultivated by the Leiden Bot. Gard., s.n. (holotype, W).

Anathallis rigidula (Cogniaux) Luer, comb. nov. Basionym: *Pleurothallis rigidula* Cogniaux, Fl. Bras. (Martius) 3(4): 572, tab. 120, fig. 1. 1896.

Specklinia rigidula (Cogniaux) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 263. 2004. TYPE: Brazil. Rio de Janeiro: s. loc., 1892, *A. Glaziou 19888* (lectotype, designated here, K; isotype, C).

The holotype collection of *Glaziou 19888* was destroyed in Dahlem, but two isotypes exist at K and C, and the Kew sheet is preferred as lectotype.

Pabstiella

Pabstiella dryadum (Schlechter) Luer, comb. nov. Basionym: *Pleurothallis dryadum* Schlechter, Anexos Mem. Inst. Butantan, Secc. Bot. 1(4): 45, pl. 8. 1922, non *Pleurothallis dryadum* Schlechter, 1923. *Specklinia dryadum* (Schlechter) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 260. 2004. *Anathallis dryadum* (Schlechter) F. Barros, Orchid Memories 10. 2004. TYPE: Brazil. São Paulo: Est. Rio Grande, near Serra Cubatão, 17 Aug. 1913, *A. C. Brade 6882* (lectotype, designated by F. Barros, 2004, HB 8247; isotype, SP 4619).

Pabstiella pellifeloidis (Barbosa Rodrigues) Luer, comb. nov. Basionym: *Lepanthes pellifeloidis* Barbosa Rodrigues, Revista Engen. 3: 110. 1881. *Pleurothallis pellifeloidis* (Barbosa Rodrigues) Cogniaux, Fl. Bras. (Martius) 3(4): 515, tab. 104, fig. 1. 1896, as "*pellifeloides*." *Stelis pellifeloidis* (Barbosa Rodrigues) Pridgeon & M. W. Chase, Lindleyana 16: 265. 2001. *Specklinia pellifeloidis* (Barbosa Rodrigues) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 262. 2004. TYPE: Brazil. Rio de Janeiro: near Rodeio, May, *J. B. Rodrigues s.n.* (lectotype, designated here, Barbosa Rodrigues' original illustration at RB, Iconographie JBR, Vol. 3: tab. 747).

Pabstiella piraquarensis (Hoehne) Luer, comb. nov. Basionym: *Pleurothallis piraquarensis* Hoehne, Arq. Bot. Estado São Paulo, n.s., 2(6): 123, tab. 53, fig. 2. 1952. *Stelis piraquarensis* (Hoehne) Pridgeon & M. W. Chase, Lindleyana 16: 265. 2001. *Specklinia piraquarensis* (Hoehne) Luer, Monogr. Syst. Bot. Missouri Bot. Gard. 95: 263. 2004. TYPE: Brazil. Paraná: Piraquara, estr. Graciosa, Alto da Serra, 22 Apr. 1951, *G. Hatschbach 2207* (holotype, SP 55381; isotype, AMES).

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Three New Creeping *Peperomia* Species (Piperaceae) from Ecuador

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Abstract. Three creeping Ecuadorian species of *Peperomia* Ruiz & Pavón are presented as new to science. Both *P. parcipeltata* G. Mathieu and *P. sagittata* G. Mathieu occur in northern Ecuador, while *P. gracilispica* G. Mathieu occurs in central Ecuador. The three species are considered as belonging to section *Leptorhynchum* Dahlstedt.

Key words: Ecuador, epiphyte, IUCN Red List, *Peperomia*, Piperaceae.

The last complete revision of *Peperomia* Ruiz & Pavón dates back more than 80 years (de Candolle, 1923). Since then, the number of published names in the genus has almost tripled to 3073, 1613 of which are currently considered by the author as representing distinct taxa. The "Taxonomic Repertory of the Genus *Peperomia*" (Mathieu, 2001–2007) provides these precise overall numbers and, resulting from the meticulous screening of about 100,000 herbarium specimens, also yields occurrence data for particular regions. These show that, although in absolute species numbers Ecuador (230) is exceeded by Colombia (245) and Peru (398), the species density of *Peperomia* in Ecuador (number of species compared to country area) is ca. three-fold that of these neighboring countries (Mathieu, 2007). It is therefore not surprising that an Ecuadorian *Peperomia* expedition in 2004 has revealed ca. 25 undescribed species. Evaluating the harvest of the expedition, more than 10,000 Ecuadorian specimens of *Peperomia* have been screened in herbaria in Europe and North and South America. Among the unidentified specimens, three additional undescribed species were found that are validated here. *Peperomia gracilispica* G. Mathieu occurs on the eastern Andean slopes of central Ecuador. *Peperomia sagittata* G. Mathieu occurs on the western Andean slopes of northern Ecuador, while *P. parcipeltata* G. Mathieu is a species of lowland humid forests in the province of Esmeraldas. The creeping habit of the three species and the morphology of their ovary and fruit agree best with section *Leptorhynchum* Dahlstedt (Dahlstedt, 1900). However, Dahlstedt's commonly adopted infrageneric classification is outdated and currently under revision. The three species are better assigned to the preliminary F clade (Wanke et al., 2006: 98, fig. 1), which includes *Leptorhynchum*. The extended herbarium screening mentioned above shows that these species were apparently never collected outside Ecuador. IUCN conservation status is discussed for each species (IUCN, 2001).

1. Peperomia gracilispica G. Mathieu, sp. nov. TYPE: Ecuador. Morona-Santiago: Los Tayos, on ledge overhung by limestone rocks in shade near the cave entrance, 03°07′S, 78°14′W, 700 m, 12 July 1976, *G. Argent 66* (holotype, MO; isotype, QCA). Figure 1.

Herba tenuis, repens; caulis filiformis, glaber, e nodis radicans. Folia alterna; petiolus gracilis, sulcatus, marginibus sulci nodum cingentibus et in costulas internodii decurrentibus; lamina membranacea, ovata vel elliptica, basi subcordata vel rare paulo peltata, apice acuminato, utrinque glabra, margine foliorum juniorium ciliata, palmatim 5-nervata, nervis lateralibus currentibus ad marginem parallellis et in apice nervum centralem conjugantibus. Inflorescentia terminalis; spica filiformis solitaria vel binae; pedunculus glaber; rhachis laxiflora; bracteae florales orbiculatae. Antherae parvae subsessiles; ovarium stigmate apicali fimbriato.

Herb delicate, creeping; stems filiform, glabrous, rooting at the nodes, internodes 3–5.5 cm. Leaves alternate; petiole slender, to 3 cm, sulcate, the side ribs continuing through node into internodal ribs; leaf blade membranous, ovate to elliptic, to 4.5 × 2.5 cm, with length:width ratio of 1.6:2.0, base cordate, only exceptionally peltate ca. 1 mm from base, apex acuminate, glabrous abaxially and adaxially, margin of young leaves scarcely ciliate, older leaves usually eciliate, palmately 5-nerved, the lateral nerves continuing as fine nerving parallel to margin and joining central nerve at apex. Inflorescence a terminal, filiform spike, solitary or 2; peduncle ca. 1.5 cm, glabrous; rachis to 6 cm and 0.5 mm diam., loosely flowered, the individual flowers to 2 mm distant; floral bracts orbicular, ca. 0.5 mm diam. Anthers small, subsessile, often only 1 stamen per flower; ovary with apical fimbriate stigma. No mature fruits present in mid-July.

Distribution, habitat, and IUCN Red List category. The new species is known only from the type locality, situated in premontane forest on the eastern

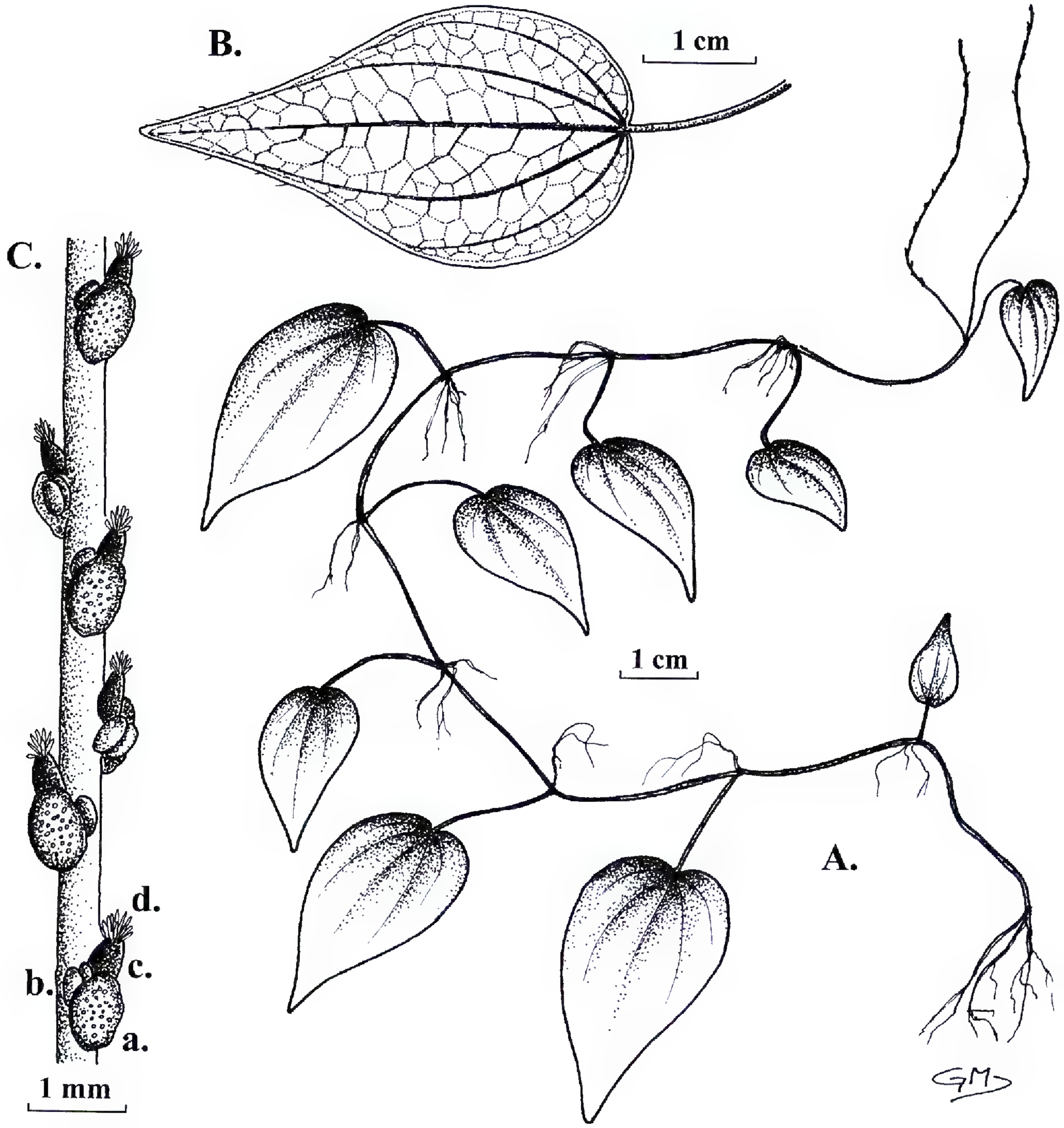

Figure 1. *Peperomia gracilispica* G. Mathieu. —A. Habit. —B. Abaxial leaf detail, venation pattern. —C. Part of filiform rachis with distant flowers: —a. floral bract, —b. anther, —c. ovary, —d. stigma. Drawn from the type, *Argent 66* (MO).

Andean slopes of central Ecuador. The precise type locality description may facilitate additional collections in August and September, when mature fruits are expected to be present. The Cave of the Oilbirds (Cuevo de Los Tayos) is situated ca. 100 km east of Cuenca, between Limón and Santiago in the valley of the Río Coangos in Ecuador. The species is known from a single location with an estimated area of occupancy of less than 10 km^2 and therefore should be considered Critically Endangered (CR B2a) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet *gracilispica* refers to the conspicuous thread-like inflorescences.

Relationships. In general habit *Peperomia gracilispica* shows some resemblance to *P. parcipeltata*, which follows as newly described. *Peperomia parcipeltata* may easily be distinguished by its thread-like spikes and, in its vegetative stage, by the more ovate, abaxially distinctly nerved and only occasionally peltate leaves.

2. Peperomia parcipeltata G. Mathieu, sp. nov. TYPE: Ecuador. Esmeraldas: along Lorenzo–Mataje rd., 0.4 km W of Lita–San Lorenzo hwy., 7.5 km N of Gasolinera San Lorenzo, 01°14′30″N, 78°45′50″W, 60 m, 11 July 2000, *T. Croat 83876* (holotype, MO; isotype, QCNE). Figure 2.

Herba epiphytica, repens; caulis filiformis, pubescens pilis ad apicem curvatis, e nodis radicans. Folia alterna; petiolus sulcatus, in sulco pubescens; lamina elliptica, basi

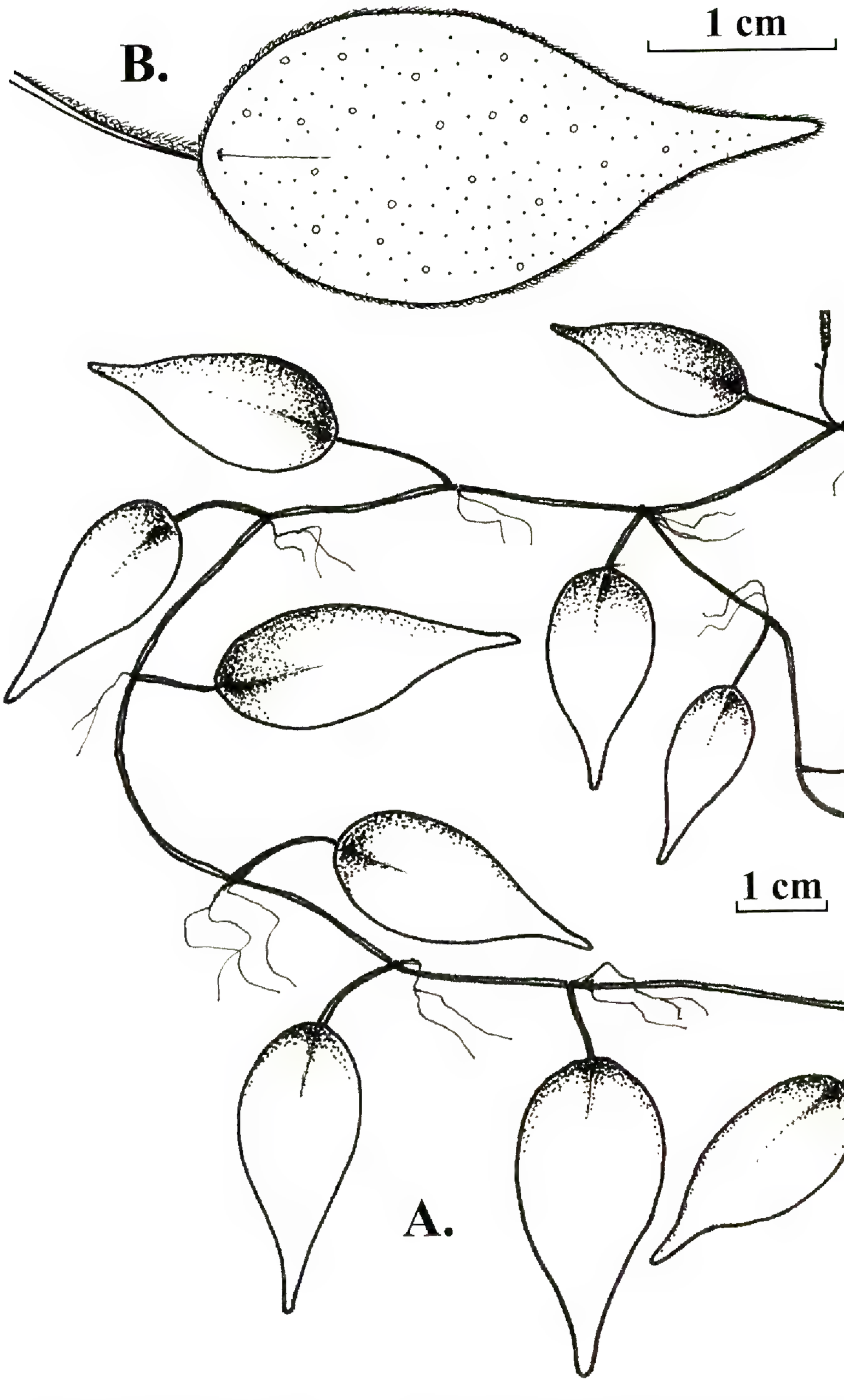

Figure 2. *Peperomia parcipeltata* G. Mathieu. —A. Habit. —B. Adaxial leaf surface. Drawn from the type, *Croat 83876* (MO).

rotundata, prope basem (1–2 mm) peltata, apice acuminato, utrinque glabra, utrinque glandulopunctata, margine in foliis junioribus confertissime ciliata, supra nervis vix visibilibus, subtus nervo centrali prominenti. Inflorescentiae solitariae terminales axillaresque; pedunculus pubescens, pedunculi pilis erectis brevioribusque quam caulis, bractea pedunculi unica parva pubescentique; rhachis modice densiflora; bracteae florales clare glandulopunctatae. Antherae conspicuae, subsessiles.

Herb epiphytic, creeping; stems filiform, pubescent with apically curved trichomes, rooting at the nodes, internodes 2.5–3(–5) cm. Leaves alternate; petiole 1–2 cm, sulcate, pubescent in petiole groove; leaf blade elliptic, base rounded, consistently peltate 1–2 mm from base, apex acuminate, to 3.5 × 1.8 cm, glabrous abaxially and adaxially, with whitish glandular dots smaller than 0.1 mm diam. and alternate with fewer vesicles 0.3–0.4 mm diam., blade margins entirely ciliate, dense in young leaves, less so in older leaves, nerves adaxially scarcely visible, abaxially only the central nerve prominent. Inflorescences terminal, axillary, solitary; peduncle ca. 1 cm, pubescent, with trichomes erect and shorter than on

the stem, one small peduncular pubescent inflorescence bract present, ca. 1 mm; rachis 1–1.5 cm, moderately densely flowered, parts of the rachis visible between individual flowers; floral bracts 0.3–0.4 mm diam., clearly glandular-dotted. Anthers conspicuous, almost the size of the floral bracts, subsessile. Mature fruits not seen.

Distribution, habitat, and IUCN Red List category. All known collections are from humid tropical forests of low elevation (60–250 m) from the northern province of Esmeraldas in Ecuador. The species is known from fewer than five locations with an estimated area of occupancy of less than 500 km^2 and therefore should be considered Endangered (EN B2a) according to IUCN Red List criteria (IUCN, 2001).

Etymology and relationships. The specific epithet refers to a distinctive character: leaves are consistently peltate 1–2 mm from the base. Peltate leaves are common in the tuberous species of *Peperomia* and in some large-leaved species like *P. choroniana* C. DC., *P. hernandiifolia* (Vahl) A. Dietrich, and *P. maculosa* (L.) Hooker. Although it may be observed occasionally in *P. gracilispica*, previously described, it is a rare feature in the small-leaved creeping species. *Peperomia parcipeltata* resembles *P. cacaophila* Trelease & Yuncker in its general habit. The latter, however, has a much shorter and glabrous petiole and lacks the ciliate margin, but especially shows an acute base instead of the rounded peltate base of *P. parcipeltata*.

Paratypes. ECUADOR. **Esmeraldas:** Reserva Ecol. Cotacachi-Cayapas, Charco Vicente, Río San Miguel, 00°43′N, 78°53′W, 6–9 Sep. 1993, *W. Palacios 11275* (MO not seen, QCNE), 20–31 Sep. 1993, *M. Tirado 317* (MO, QCNE); Reserva Ecol. Cotacachi-Cayapas, Parroquia Luis Vargas Torres, Río Santiago, 00°49′N, 78°45′W, 23–27 Oct. 1993, *M. Tirado 510* (BR, MO, QCNE).

3. Peperomia sagittata G. Mathieu, sp. nov. TYPE: Ecuador. Carchi: perhumid forest on wet plateau above San Marcos de los Coaiqueres, on trail toward Gualpí Bajo, 01°06′N, 78°17′W, 1000 m, 7 Feb. 1985, *B. Øllgaard 57399* (holotype, BR; isotype, AAU). Figure 3.

Herba epiphytica, repens; caulis filiformis, simplex vel modice ramosus, pubescens, e nodis radicans, rubrotinctus. Folia alterna; petiolus sulcatus, sulco dense pubescenti; lamina deltoidea, saepe paulo longior quam latior, basi truncata vel leviter cordata, apice late acuminato, supra glabra glandulopunctataque, subtus basi nervo centrali pubescenti, margine dense ciliata. Inflorescentiae solitariae terminales axillaresque; pedunculus pubescens, ad medium bractea unica aliquando decidua; rhachis glabra; bracteae florales irregulariter orbiculatae, glandulopunctatae. Antherae subsessiles, deciduae. Drupa superficie papillata, papillis impariter distributis, stigmate sessili rostro longo papillato abaxiali.

Herb epiphytic, creeping; stems filiform, simple or moderately branched, pubescent, rooting at nodes, tinged red, internodes 1–1.5 cm. Leaves alternate; petiole sulcate, the groove densely pubescent, 7–13 mm; leaf blade deltoid, base truncate or slightly cordate, apex broadly acuminate, to ca. 14 × 14 mm, often a little longer than wide, glabrous and clear glandular-dotted adaxially, central nerve hardly visible adaxially, clearly visible to apex abaxially, pubescent along basal portion of central nerve abaxially, margin densely ciliate. Inflorescences terminal and axillary, solitary; peduncle pubescent, to 18 mm, with 1 bract ca. 1 mm at peduncle midpoint, sometimes deciduous; rachis to 18 mm, glabrous; floral bracts irregularly orbicular, glandular-dotted. Anthers subsessile, deciduous. Fruit a long drupe, perpendicularly inserted on the rachis, very shortly excentrically stipitate, sticky papillate, the papillae unevenly distributed and abaxially reaching farther acropetally than adaxially, persistent stigma sessile, abaxially of an entirely papillate beak, ca. 0.8 mm long.

Distribution, habitat, and IUCN Red List category. All known collections are from a rather limited area covering the western Andean slopes in the northern provinces of Carchi and Esmeraldas. The species occurs in a wet premontane forest environment at reported elevations of 660–1000 m. The species is known from fewer than 10 locations with an estimated area of occupancy of less than 2000 km^2 and therefore should be considered Vulnerable (VU B2a) according to IUCN Red List criteria (IUCN, 2001).

Etymology, uses, and relationships. The specific epithet refers to the characteristic deltoid leaf shape. In ethnobotanical use for snake bites, the leaves are boiled and applied, still hot, to the bite (as reported by Herman Dinero on *Barfød 41589*; snake species not specified). *Peperomia sagittata* is expected to be related to other small-leaved creeping *Peperomia* species, e.g., *P. serpens* (Swartz) Loudon and *P. reptans* C. DC. (the latter still better known under its synonym *P. duidana* Trelease). This is not only reflected in the general habit of the plant, but also in its fruit morphology. However, no other *Peperomia* is currently known with this particular combination of leaf shape and size. The leaves of *P. reptans* are consistently heart-shaped, while those of *P. serpens*, although quite polymorphic, are often more reniform.

Paratypes. ECUADOR. **Carchi:** along trail from San Marcos to Tobar Donoso, 01°07′N, 78°20′W, 1 Mar. 1983, *A. Barfød 41589* (AAU, BR, QCA); above San Marcos de los Coaiqueres, on trail toward Gualpí Bajo, 01°06′N, 78°17′W,

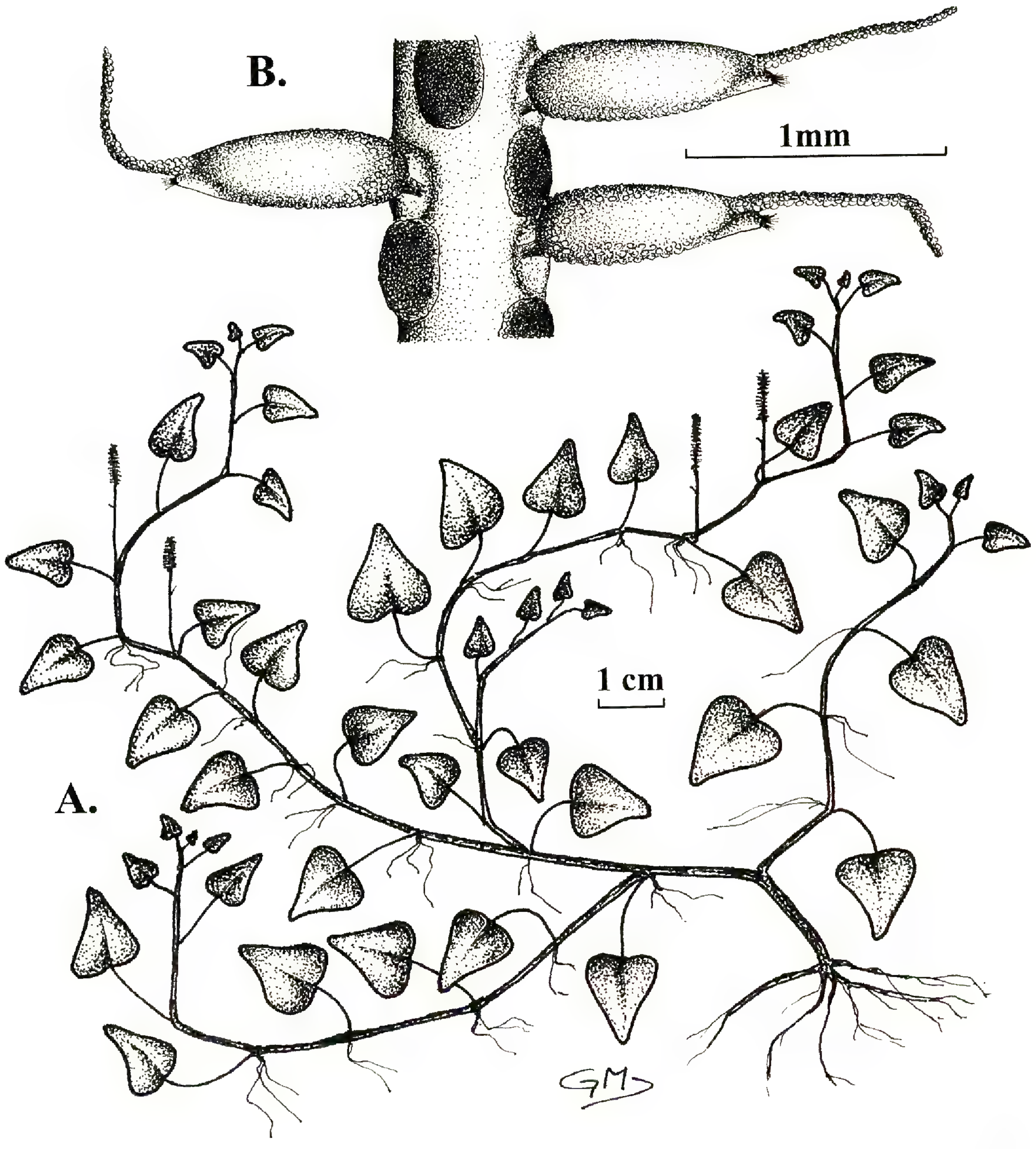

Figure 3. *Peperomia sagittata* G. Mathieu. —A. Habit. —B. Part of rachis with fruits. Drawn from the type, *Øllgaard 57399* (BR).

7 Feb. 1985, *B. Øllgaard 57232* (AAU, BR, QCA, QCNE); Reserva Etnica Awá, Gualpí Medio, 01°01′N, 78°16′W, 21 May 1992, *C. Quelal 736* (QCNE). **Esmeraldas:** Lita–Alto Tambo, Km 8, 19 July 1988, *C. Dodson 17525* (MO, QCNE); Lita–San Lorenzo rd., Alto Tambo, 17.1 km W of Rio Lita bridge, 00°54′06″N, 78°32′27″W, 10 Oct. 1999, *T. Croat 83193A* (MO); Lita–Alto Tambo, Km 17.5, entrance to Reserva Ecol. Cotacachi-Cayapa, 00°53′N, 78°33′W, 5 Nov. 1994, *B. Øllgaard 105455* (AAU, QCA).

Acknowledgments. I thank the curators and staff of the mentioned herbaria for kindly having provided study material, and Paul Goetghebeur and Marie-Stéphanie Samain for their valuable comments.

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New Boraginaceae from Tropical America 6: A New Species of *Varronia* from Bolivia

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Abstract. *Varronia lantanifolia* J. S. Miller & J. R. I. Wood (Cordiaceae) is described from dry forest areas of Bolivia. This new species can be distinguished from other South American species of *Varronia* P. Browne with capitate inflorescences by the combination of evenly serrate, ovate, petiolate leaves; white puberulent, deltate calyx lobes with 1–2 mm long filiform apices; and a 10–15 mm long funnelform corolla.

Resumen. Se presenta una descripción de *Varronia lantanifolia* J. S. Miller & J. R. I. Wood (Cordiaceae) de los bosques secos de Bolivia. Se puede distinguir esta especie nueva de las otras especies sudamericanas de *Varronia* P. Browne que también tiene las flores dispuestas en cabezuelas por las hojas ovadas, petioladas, uniformemente serradas combinadas con los lobulos del calyce dentados con los vertices filiformes y la corolla infundibuliforme, 10–15 mm de largura.

Key words: Bolivia, *Cordia*, Cordiaceae, IUCN Red List, *Varronia*.

The genus *Cordia* L. comprises about 350 species of trees and shrubs that are widely distributed throughout the tropics, but most of the species and taxonomic diversity are found in the New World, there being only about 50 species in the Old World. *Cordia* s.l. comprises several distinct clades that are distinct morphologically, and taxonomic opinions have varied on whether these should be recognized as distinct genera or as four to seven subgenera or sections (e.g., Johnston, 1930) of a more broadly defined *Cordia*. *Cordia* sect. *Varronia* (P. Browne) D. Don has been considered among the most distinct of these clades (review in Miller & Gottschling, 2007), and it comprises about 100 Neotropical species of multi-stemmed shrubs with condensed inflorescences and evenly serrate leaves, whereas the other sections of *Cordia* are trees with entire leaves and cymose or paniculate inflorescences. In addition, *Cordia* sect. *Varronia* differs from the rest of *Cordia* in having pollen with porate apertures (Nowicke & Miller, 1990). Despite these differences, recent students of Boraginaceae (s.l.) have been hesitant to recognize *Varronia* at the generic level, and most have treated it as a section of *Cordia* (e.g., Johnston, 1930; Taroda & Gibbs, 1986a, b; Miller, 1988), with the notable exception of Borhidi et al. (1988), who recognized *Cordia*, *Gerascanthus* P. Browne, and *Varronia* P. Browne. With the recent availability of molecular data (Gottschling et al., 2005), it has become evident that *Varronia* is sister to the rest of *Cordia* and should be recognized at the generic level (Gottschling & Miller, 2006; Miller & Gottschling, 2007).

Varronia has not been comprehensively treated taxonomically since de Candolle (1845). Study of the group has been completed as part of the floristic studies of various parts of the New World tropics including Mexico and Central America (Johnston, 1949), Venezuela (Gaviria, 1987), and Brazil (Johnston, 1930; Taroda & Gibbs, 1986a). E. P. Killip prepared a revision of *Cordia*, including *Varronia*, for Andean South America, but it was never published and only a small percentage of the species he intended to recognize were ever published (a copy of Killip's manuscript remains in the collection at the Smithsonian Institution).

The new species described here was collected in the dry valleys of the central Andean region of Bolivia. Although the eastern slopes of the Bolivian Andes are generally covered in moist forest of various types, these forested areas are set apart from the altiplano that lies at an altitude of between 3500 and 4000 m by a series of deep dry valleys separated by slightly more humid ridges. *Varronia lantanifolia* J. S. Miller & J. R. I. Wood is a plant of these deep dry valleys, which have a xerophytic chaco-type vegetation. This consists of very open dry forest with scattered trees, typically species of Anacardiaceae (most commonly *Schinopsis haenkeana* Engler and

Loxopterygium grisebachii Hieronymus ex H. Lorentz) and Fabaceae, notably *Prosopis kuntzei* Harms and *Anadenanthera colubrina* (Velloso) Brenan. There are abundant shrubs and cactus such as *Acacia furcatispina* Burkart (Fabaceae), *Plenckia integerrima* Lundell (Celastraceae), and *Harrisia tetracantha* (Labouret) D. R. Hunt (Cactaceae), as well as species of *Jatropha* L. (Euphorbiaceae) and *Ruprechtia* C. A. Meyer (Polygonaceae). Ground vegetation is sparse. Although relatively accessible, this region has been poorly explored botanically, and new species, endemic to the region, are continually being reported, such as the cactus *Espostoa guentheri* (Kupper) Buxbaum ex Eggli, the legume trees *Acacia riograndensis* Atahuachi & L. Rico and *Myrocarpus emarginatus* A. L. B. Sartori & A. M. G. Azevedo, herbs such as *Gomphrena stellata* T. Ortuño & Borsch (Amaranthaceae) and *Philibertia globiflora* Goyder (Apocynaceae), and understory shrubs such as *Salvia graciliramulosa* Epling & Játiva (Lamiaceae) and the *Varronia* described below.

Varronia lantanifolia J. S. Miller & J. R. I. Wood, sp. nov. TYPE: Bolivia. Potosí: Charcas, en el camino del puente del Río Caine hacia Torotoro a 5 km del puente, 2050 m, 17°58′S, 65°50′W, 5 Jan. 2005 (fl), *J. R. I. Wood, M. Mercado & T. Ortuño 21340* (holotype, MO; isotypes, BOLV, K, LPB). Figure 1.

Frutex 0.3–1 m alta, ramunculis strigillosis. Folia decidua, alterna; lamina ovata, 1–3.5 cm longa, 0.4–0.6 cm lata, apice acuta, basi obtusa vel cuneata et leviter decurrentia, margine serrata, utrinque strigosa, vel pubescentia; petiolo 1–9 mm longo. Inflorescentiae terminales vel subterminales, capitatae, usque ad 14 mm diam., pedunculis 0.5–5.5 cm longis. Flores bisexuales, distyli; calyce urceolato, albistrigilloso, 5-lobo, lobis ad apicem 1–2 mm longis; corolla infundibuliformis, 10–15 mm longa.

Shrubs 0.3–1 m tall, the stems evenly white strigillose. Leaves alternate, deciduous; blades ovate, corrugate, 1–3.5 × 0.4–0.6 cm, the apex acute, the base obtuse to cuneate and slightly decurrent, the margins evenly serrate, the adaxial surface evenly strigose between the secondary veins, the abaxial surface strigose to curly pubescent, the venation craspedodromous, the midrib and 6 to 8 secondary veins impressed above; petioles 1–9 mm, canaliculate on the adaxial surface, densely to sparsely strigose to strigillose. Inflorescences terminal or subterminal, capitate, 7–14 mm diam., the peduncles 0.5–5.5 cm, white strigillose. Flowers bisexual, distylous; calyx urceolate, ca. 3 mm long, 2 mm wide at the mouth, the sides white and papery, the exposed apical portion green and white strigillose, the 5 lobes deltate, with 1–2 mm filiform tips; corolla funnelform, 10–15 mm, 5-lobed, the lobes obcordate and deeply enough divided that the corolla appears shallowly 10-lobed; stamens 5, the filaments 4–10 mm, basally connate, the upper 2–5 mm free, glabrous, the anthers oblong, ca. 1 mm; ovary conical, ca. 0.5 mm tall, 0.5 mm wide, perched atop a 1 mm broad disc, the style ca. 2.5–7 mm, the stigmas filiform. Fruits not seen.

Distribution and habitat. *Varronia lantanifolia* is endemic to the valleys of the Río Grande and its tributaries in central Andean Bolivia, occurring within a restricted area although entering adjacent parts of four different Departments. It is a plant of open, dry bushland with scattered shrubs and trees between about 1500 and 2100 m, with a marked preference for outcrops of red sandstone. It is readily eaten by goats, and large specimens are often seen on cliffs or growing in the protection of spiny shrubs. Although not especially rare, it was never seen in great abundance (Wood, pers. obs.). The specimen label of *Cardenas 4239* (US) indicates that it was collected at 1180 m, but this is probably an error for 1800 m, as this is the minimum altitude in the area where this collection was made. The limited collections available document flowering between November and February.

IUCN Red List category. As with many newly discovered species, *Varronia lantanifolia* is known from a limited number of collected specimens, which makes it difficult to estimate its conservation status solely from limited geographic data. It may have gone uncollected because it only flowers briefly after good rainfall, as it is widely distributed in the hot dry valleys of the Río Grande and Río Mizque, growing in areas undergoing some degradation through excessive goat herding but otherwise subject to little other threat. Strict application of IUCN Red List criteria (IUCN, 2001) using only the limited specimen locality information available would yield an Extent of Occurrence of 8038 km², below the 20,000 km² threshold to be considered Vulnerable (VU), and an Area of Occupancy of 45 km², below the threshold of 500 km² to be considered Endangered (EN), although using a 3 × 3 km grid cell, it would be impossible for a species known from only six collections to exceed the endangered threshold for Area of Occupancy. The relatively wide distribution of this species, its propensity to grow in inaccessible places, and the field observations of extant populations by the second author should override the results of analysis of such limited specimen data indicating that the species is not under any immediate threat and it should be tentatively categorized as Least Concern (LC).

Relationships. The genus *Varronia* separates into three loosely defined groups based on whether

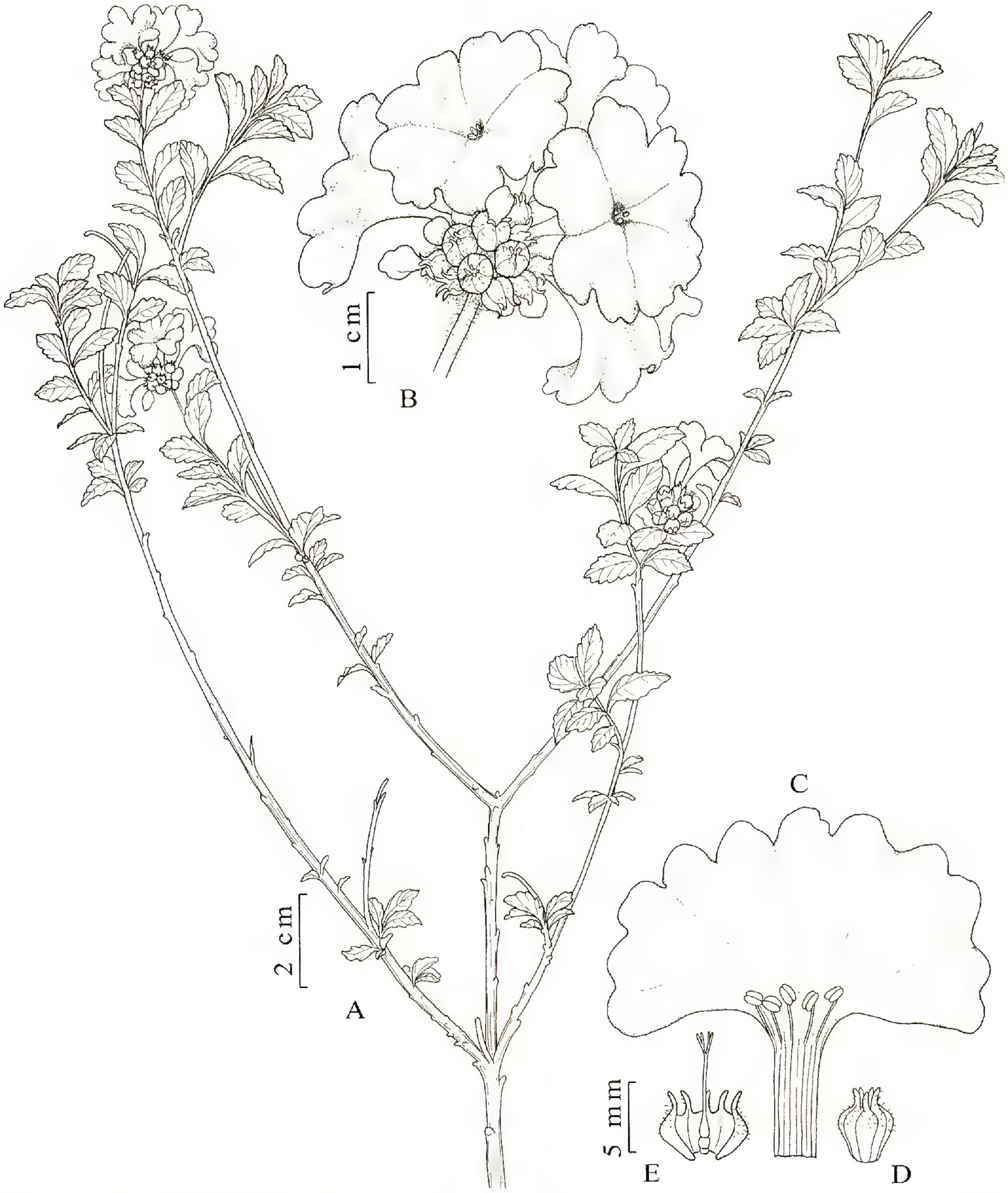

Figure 1. *Varronia lantanifolia* J. S. Miller & J. R. I. Wood. —A. Habit, flowering branch. —B. Inflorescence with open corollas. —C. Corolla opened to show insertion of stamens. —D. Unopened calyx. —E. Opened calyx with gynoecium. All from *Wood et al. 21340* (MO, holotype).

inflorescences are cymose, spicate, or capitate. There are probably 30 to 40 species of *Varronia* with capitate inflorescences, and these can be further separated into two groups depending on whether the calyx lobes are acute or have elongate (ca. 2–6 mm) filiform calyx teeth. This new species has acute calyx lobes with short (1–2 mm) filiform apices, which seems to ally it with *V. guaranitica* (Chodat & Hassler) J. S. Miller and *V. leucocephala* (Moricand) J. S. Miller, two other South American species. Its combination of petiolate leaves, which are ovate and broadest below the middle, evenly serrate leaf margins, deltate calyx lobes with 1–2 mm filiform teeth, a white strigillose indument on the exterior surface of the calyx, and a 10–15 mm long funnelform corolla easily separate this species from others with which it might be confused.

Varronia lantanifolia is perhaps most likely to be confused with *V. guaranitica*, a species known from

Brazil, Paraguay, and Argentina that differs in having sessile oblanceolate leaves broadest above the middle and a brown indumenta on its young stems, peduncles, and calyces. *Varronia guaranitica* is often a small plant appearing to have short, annual stems arising from a thickened persistent rootstock; the underground parts of *V. lantanifolia* are not known. *Varronia leucocephala* also shares somewhat similar leaves and inflorescences but has larger corollas and no filiform projections on the apex of the calyx lobes. Furthermore, it is known only from northeastern Brazil.

Varronia lantanifolia appears to be distylous, as reported in other species of *Varronia* (Opler et al., 1975); *Cardenas 4239* represents a long-styled plant, while *Wood et al. 21340*, *Wood et al. 21250*, and *Gutiérrez et al. 401* are short-styled plants. Additional collections will be required to confirm the breeding system of this species.

Paratypes. BOLIVIA. **Chuquisaca:** Oropeza, Noctulo, ca. a 1 km de Noctulo, trayecto Sucre–Cochabamba, 1859 m, 18°47.3′S, 65°07′W, *J. Gutiérrez, R. Lozano & M. Mendoza 401* (K). **Cochabamba:** Arce, Río Caine, *M. Cardenas 4239* (US); Campero, Peña Colorada, 1–2 km E of village along rd. to Saipina, 1800 m, *J. R. I. Wood 9366* (BOLV, K, LPB); Campero, Pasorapa, en la bajada del Buenavista hacia el Río Grande, 1492 m, 18°36.23′S, 64°32.73′W, fl, *J. R. I. Wood, M. Atahuachi & M. Mercado 21250* (K, MO). **Santa Cruz:** Caballero, ca. 10 km E of Empalizada on rd. to Mairana, 1973 m, 18°05.15′S, 64°23.17′W, fl, *M. Mendoza & E. Calzadilla* 808 (LPB, USZ); Caballero, on descent of Río San Isidro betw. Pulquina and La Tranca, 1536 m, 18°07.87′S, 64°26.62′W, fl, *J. R. I. Wood, N. P. Taylor & N. Rojas 22529* (K, LPB, USZ).

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A New Species of *Polygala* (Polygalaceae) from Brazil

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Abstract. One new species for Polygalaceae from Brazil is described, illustrated, and compared with related species of *Polygala* L. subg. *Hebeclada* (Chodat) S. F. Blake. *Polygala marquesiana* J. F. B. Pastore & T. B. Cavalcanti is an attractive caespitose subshrub from the state of Goiás, occurring in the high-altitude areas of Serra Geral do Paranã in the central part of the Brazilian savannas.

Resumo. Uma nova espécie de Polygalaceae para o Brasil é descrita, ilustrada e comparada com espécies relacionadas de *Polygala* L. subgênero *Hebeclada* (Chodat) S. F. Blake. *Polygala marquesiana* J. F. B. Pastore & T. B. Cavalcanti é um belo subarbusto do estado de Goiás, que ocorre em elevadas altitudes da Serra Geral do Paranã, na porção central do cerrado brasileiro.

Key words: Brazil, IUCN Red List, *Polygala*, Polygalaceae, subgenus *Hebeclada*.

Expeditions in Brazil have been undertaken to increase the knowledge of the Brazilian Polygalaceae. These efforts have resulted in the collection of many interesting plants of the family, a number of which represent rare and endemic species. *Polygala* L. is first among the 18 genera in number of species in the Polygalaceae, with about 730 recognized species (Paiva, 1998) and 180 Brazilian species (Marques, 1979, 1984). The genus is widely distributed in all continental areas globally except in the Arctic, Antarctic, and New Zealand (Paiva, 1998), with the greatest diversity concentrated in South America. Ongoing efforts to revise *Polygala* species in the state of Goiás, within the central Brazilian savanna, have confirmed the presence of one species as undescribed in the genus.

The subgenus *Hebeclada* (Chodat) S. F. Blake is morphologically well delimited from the other subgenera of *Polygala* (Marques, 1979) by the upper posterior sepals, which are almost fully connate, with the style curved at a 90° angle and 4–5 times longer than the ovary and with the keel ecristate. Some studies, such as those of Eriksen (1993) and Persson (2001), provide evidence that subgenus *Hebeclada* would be better treated as a distinct genus. However, the application of a generic name for this taxon depends not only on the results of a phylogenetic analysis, but also on a question of nomenclature regarding the status of Rafinesque's generic name *Alsemeia*, previously used by Small (1933).

Polygala subg. *Hebeclada* is only known from continental America (Marques, 1979) with a total of about 22 species. Members of the group are well represented in the Brazilian flora, the majority of which are endemic to high-altitude serras of the Campos Rupestres biome. In the Chapada dos Veadeiros of Goiás State alone, 12 species have been identified, four of which are endemic: *P. xyloclada* Chodat, *Polygala* sp. ined. 1, *Polygala* sp. ined. 2, and *P. marquesiana*.

Polygala marquesiana J. F. B. Pastore & T. B. Cavalcanti, sp. nov. TYPE: Brazil. Goiás: Alto Paraíso, povoado de São Jorge, beira da estrada para Colinas do Sul, após 4 km de São Jorge, ca. 14°11′48″S, 47°50′34″O, 16 Nov. 2007 (fl), *Pastore et al. 2325* (holotype, CEN; isotypes HUEFS, K, MO, NY, RB). Figure 1.

Polygala marquesiana ad subgen. *Hebecladam* (Chodat) S. F. Blake sepalis superioribus externis fere omnino connatis et carena non cristata pertinens. *Polygalae hebecladae* DC. affinis sed bracteis post anthesim persistentibus et trichomatibus in foliis caulibusque sericeis differt. Ab omnibus speciebus subgeneris *Hebecladae* disco basi ovarii praesentia et foliis distalibus linearibus differt.

Caespitose herbs 25–36 cm tall, less congested distally; stems 1.8–2 mm diam., cylindric, rigid,

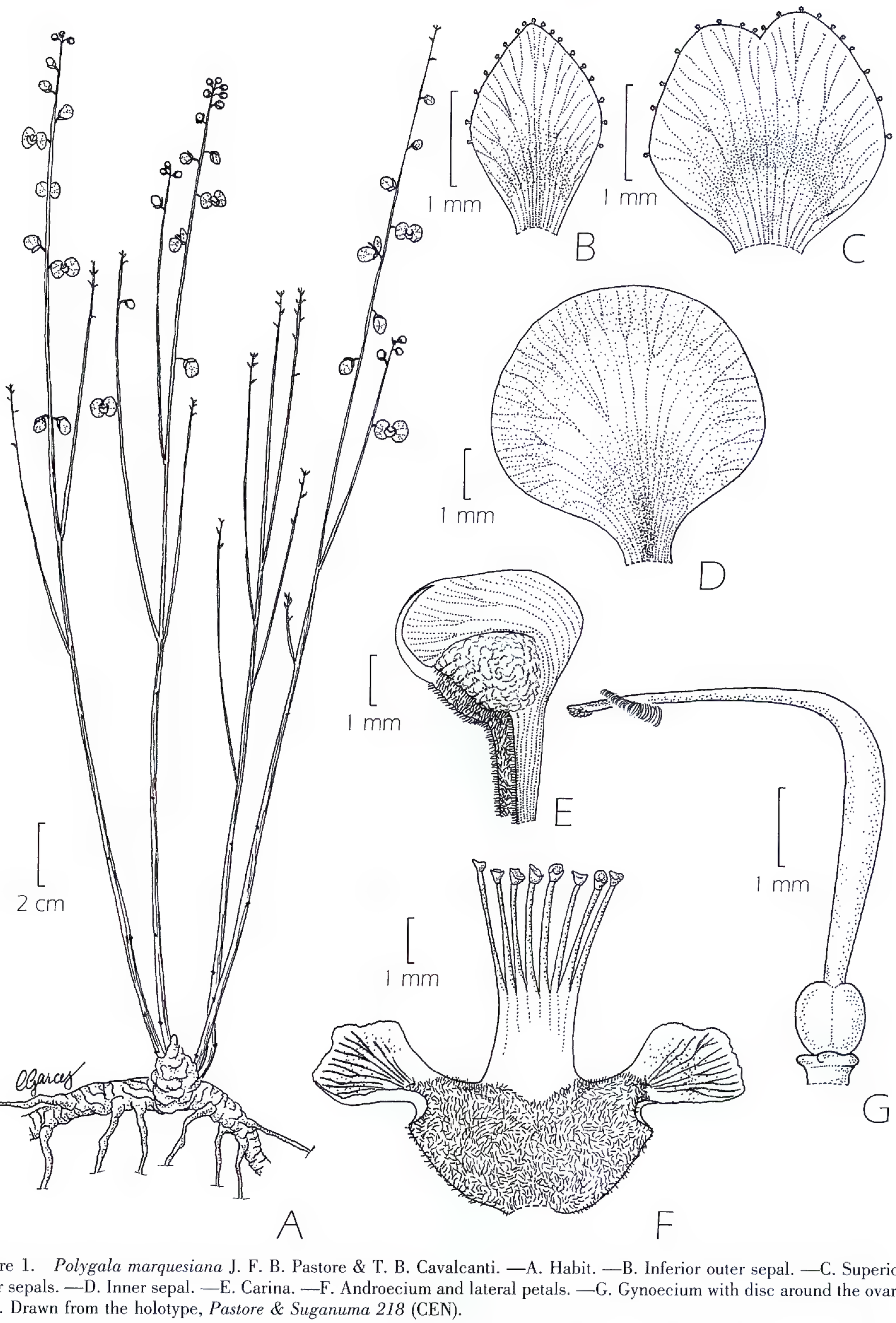

Figure 1. *Polygala marquesiana* J. F. B. Pastore & T. B. Cavalcanti. —A. Habit. —B. Inferior outer sepal. —C. Superior outer sepals. —D. Inner sepal. —E. Carina. —F. Androecium and lateral petals. —G. Gynoecium with disc around the ovary base. Drawn from the holotype, *Pastore & Suganuma 218* (CEN).

glaucous, green to purple at the base, glandular-punctate, trichomes glandulous and sparse, basally more concentrated; roots fleshy, well developed, white to yellow. Leaves minute in size, 1–4 × 1–3 mm, diminishing in size toward stem-apex, linear, caducous, green to purple when young, glabrous to glabrescent, subsessile. Terminal raceme 3–10 cm, lax; rachis striate, glabrous or with sparse simple

Table 1. Morphological comparison of *Polygala marquesiana* and related species.

	Inner sepals (wings)	Pedicel	Indument of stems	Leaf	Bracts
P. xyloclada	suborbicular	curved	puberulent	elliptic to oval	subpersistent
P. rhodoptera	suborbicular	curved	pubescent	elliptic to oval	persistent
P. hebeclada	elliptic	erect or patent	pubescent	elliptic to oval	persistent
P. marquesiana	suborbicular	curved	puberulent	linear	caducous
Polygala sp. ined. 1	elliptic	curved	pubescent	linear	persistent

trichomes, glandular-punctate; pedicel 2–3 mm, curved in fructification, glabrous or with fine, sparse trichomes; bracts and bracteoles glabrous, linear, delicate, caducous, the central ones 2 mm, the lateral ones 0.3 mm. Flowers 6–8 mm; outer sepals subequal, green, sometimes purple, subfleshy, apex acute, concave, venation dichotomous, conspicuous, glandular trichomes on the margin; the inferior sepal 3.6–3.9 × 3–3.1 mm; the superior sepals 2.5–2.8 × 2.7–3 mm, almost completely connate to the margin; inner sepals (wings) 5.3–6 × 5.3–6.5 mm, suborbicular, lilac, equal to or shorter than the carina, apex rounded, venation dichotomous, conspicuous; lateral petals ca. 5 × 2.1 mm, lilac with transverse white stripes toward apex, rose to white toward base, apex rounded, basally puberulent on ventral side; keel 5–5.7 mm, deep lilac, not cristate, almost trilobate, puberulent on the inner surface, apex yellow; base ciliate, 4.6–5 mm, unguiculus 1.4–1.8 mm, cuculus 3.6–4.3 mm wide; style bent in middle at ca. 90° angle, stamens 8, filaments white, glabrous; anthers ca. 0.5 × 0.4 mm, slightly obovate, yellow; ovary ca. 0.8 × 0.8 mm, suborbicular, glabrous, pale green; disc around ovary base ca. 0.18 × 0.9 mm. Mature fruits not seen; immature capsules elliptic, green; seeds oblong, white, puberulent with white trichomes.

Distribution and IUCN Red List category. Despite the fact that neither of the two collecting sites, which are about 55 km apart at between 810 and 1010 m elevation, falls within a conservation area, the area between them and adjacent areas form part of the Chapada dos Veadeiros National Park (Goiás). It is probable, therefore, that further populations will eventually be found in the intervening areas, where access is necessarily more restricted. Our fieldwork indicates that the new species almost certainly has a total population of less than 1000 individuals. We therefore recommend that it be considered Vulnerable (VU D1) according to IUCN Red List criteria (IUCN, 2001).

Phenology and ecology. *Polygala marquesiana* is unmistakable in the field, with its deep lilac, showy flowers, caespitose habit, and presence of glandular trichomes on the stems. *Polygala marquesiana* is not only morphologically different from other members of the subgenus, but also displays unusual ecological features. *Polygala marquesiana* is rarely found fertile because the plant flowering occurs as a response to burning. This species was collected again with flowers (*Pastore et al. 2325*) after 12 subsequent visits in different months in the same area, where it was collected for the first time (*Pastore & Suganuma 218*). It is worth noting that, during all this period, no fires occurred in the collection area. *Pastore et al. 2325*, as well as the paratype, which was collected in Cavalcante, were found in an area recovering from recent fires.

It should be noted that individuals were more than a meter apart in the field but were actually linked by a fleshy root system. This indicates the importance of vegetative reproduction in this species, which could compensate for infrequent flowering, and could also explain why the species is so poorly represented in the herbaria that we visited.

Etymology. The epithet honors Brazilian botanist Maria do Carmo Mendes Marques, of the Rio de Janeiro Botanical Garden, the noted authority on Polygalaceae of South America, who has collected many interesting Polygalaceae during the course of her investigations and has published both important contributions and new species for the family.

Relationships. Closely related species (*Polygala hebeclada*, *P. rhodoptera* Martius ex A. W. Bennett, *P. xyloclada*, and *Polygala* sp. ined. 1) are analyzed in Table 1.

Paratype. Brazil. **Goiás:** Goiás: Alto Paraíso, povoado de São Jorge, beira da estrada para Colinas do Sul, ca. 14°10′46″S, 47°49′01″O, 4 Jan. 2003 (fl), *Pastore & Suganuma 218* (CEN). Cavalcante: ponte sobre o rio Tocantins, Km 79, 13°40′50″S, 47°52′35″O, 30 Oct. 2004, *Cavalcanti et al. 3523* (BR, CEN, MO).

Acknowledgments. The authors acknowledge the herbarium staff at CEN for making material available, Elisa Suganuma for assisting in the field, Raymond M. Harley for reviewing the manuscript, Tarciso Filgueiras for preparing the Latin diagnosis, and Cristina Garcez for drawing and inking the illustration. Funding was provided through Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) grant no. 300976/95-0.

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A New Species of *Castelnavia* (Podostemaceae) from Tocantins, Brazil

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Abstract. *Castelnavia noveloi* C. T. Philbrick & C. P. Bove is distinguished from other species of *Castelnavia* Tulasne & Weddell (Podostemaceae) based on the production of stems arising perpendicular from the leaf petiole (petiolar stems) and the flattened rachis of the pinnate leaves. The new species is only known from rio Taquarussu, east of the town of Taquarussu, Tocantins, Brazil.

Resumo. *Castelnavia noveloi* se distingue das demais espécies de *Castelnavia* Tulasne & Weddell (Podostemaceae) por possuir caules que surgem perpendicularmente ao pecíolo (caules peciolares) e raque das folhas pinadas achatada. É conhecida apenas no rio Taquarussu, a leste da cidade de Taquarussu, Tocantins, Brasil.

Key words: Brazil, *Castelnavia*, IUCN Red List, Podostemaceae.

While conducting field studies in the state of Tocantins, Brazil, a species of *Castelnavia* Tulasne & Weddell was encountered that did not correspond to previously described species. It is described here as new. (In the species description below, variation is expressed as (minimum) median (maximum); N ≥ 40. The pollen grains were acetolyzed according to Erdtman [1952]; N = 25).

Castelnavia noveloi C. T. Philbrick & C. P. Bove, sp. nov. TYPE: Brazil. Tocantins: Taquarussu, 8 km E of town along Rt. TO-030, rio Taquarussu, 10°18′21.4″S, 48°10′17.7″W, 390 m, 8 June 2005, *C. T. Philbrick, A. Novelo R., C. P. Bove & D. Gera 5830* (holotype, R; isotypes, MEXU, MO, WCSU). Figures 1, 2.

Hydrophyton perenne, ad rupes in currentibus aquarum adhaerens. Caules ad petiolos perpendiculares (caulis petiolaris); caulis petiolaris ramosus multifloridus ex petiolo folii oriundus, maturitate pinnatus. Folia juventate simplicia, maturite pinnata oriundis caulis prostatis raque complanata. Flores plurimi, quisque in cavitatem in caule horizontaliter interpositus, tepalis duobus. Stamina duo. Ovarium bicarpelatum, lobis inaequalibus, lobo superiore (dorsali) minore quam inferiore (ventrali), stigmatibus duobus, sub anthesi stigmatibus et staminibus supra spathella rupta vix exsertis. Capsula costata, 2-valvata, valva superiore (dorsali) 5-costata, caduca, valva inferiore (ventrali) 7-costata, persistenti.

Aquatic herbs, perennial(?), attached to rocks in river rapids and waterfalls; roots not seen; stems in two locations, (1) prostrate on rocks, and (2) arising from leaf petioles (petiolar, epiphyllous); prostrate stems tightly attached to substratum throughout their length, cylindrical to flattened, (0.9)2(3) mm wide, repeatedly dichotomously or subdichotomously branched; petiolar stems unattached to substratum, repeatedly dichotomously or subdichotomously branched, usually curled, (0)2(9) per petiole. Leaves distichous, arising from stem margins, monothecous (with a single sheath) or dithecous (with 2 sheaths), simple when young to variously lobed or pinnate when mature; simple leaves linear to spatulate, (0.3)1.5(13) cm long, (0.2)0.4(0.8) mm wide at midpoint, spatulate upper regions (0.2)0.6(1.2) mm wide; pinnate leaves (1.7)13(22) × (0.4)1.3(6) cm, petiolate, petiole round to elliptical in cross section, (0.8)3.2(8) cm; rachis distinctly widened and flattened, (1.4)4.7(12) mm wide, (2)5(12)-veined, pinnae (0.2)1.5(9) cm, variously lobed, ultimate lobes (0.2)2.1(8) × (0.1)0.3(0.8) mm, linear, spatulate or triangular in outline, apex acute or obtuse; petiolar stems projecting (2.5)7.5(20) mm from petioles, (2)4(6) times dichotomously divided. Flowers numerous (few post-anthesal flowers observed), lateral on stems or axillary to branches, each in cavity in stem, oriented horizontally, hermaphroditic, zygomorphic, sessile or short pedicellate, covered by sac-like spathella; pedicel (0.4)0.5(0.7) mm long prior to anthesis, not elongating during anthesis, attached to ovary perpendicular to ovary axis; receptacle asymmetrically expanded on side opposite stamen attachment (asymmetry obscured in fruit as receptacle dries). Spathella clavate, (1.9)2.6(3) × (1)1.4(1.7) mm, papillate apically,

Figure 1. *Castelnavia noveloi* C. T. Philbrick & C. P. Bove. —A. One mature irregularly lobed pinnate leaf with branched stem (petiolar stem) arising from the petiole. Note incurved form of petiolar stem and expanded rachis of pinnate leaf. —B. One mature pinnate leaf and nine small young (simple) leaves arising from branched prostrate stem. Note the expanded rachis and irregularly lobed pinnae. —C. Section of prostrate stem showing five young leaves, one with apical lobes. Several additional leaf bases are also shown. —D, E. Details of pinnate leaves showing irregularly shaped lobes and branched veins. Drawings based on the holotype, *C. T. Philbrick et al. 5830* (R).

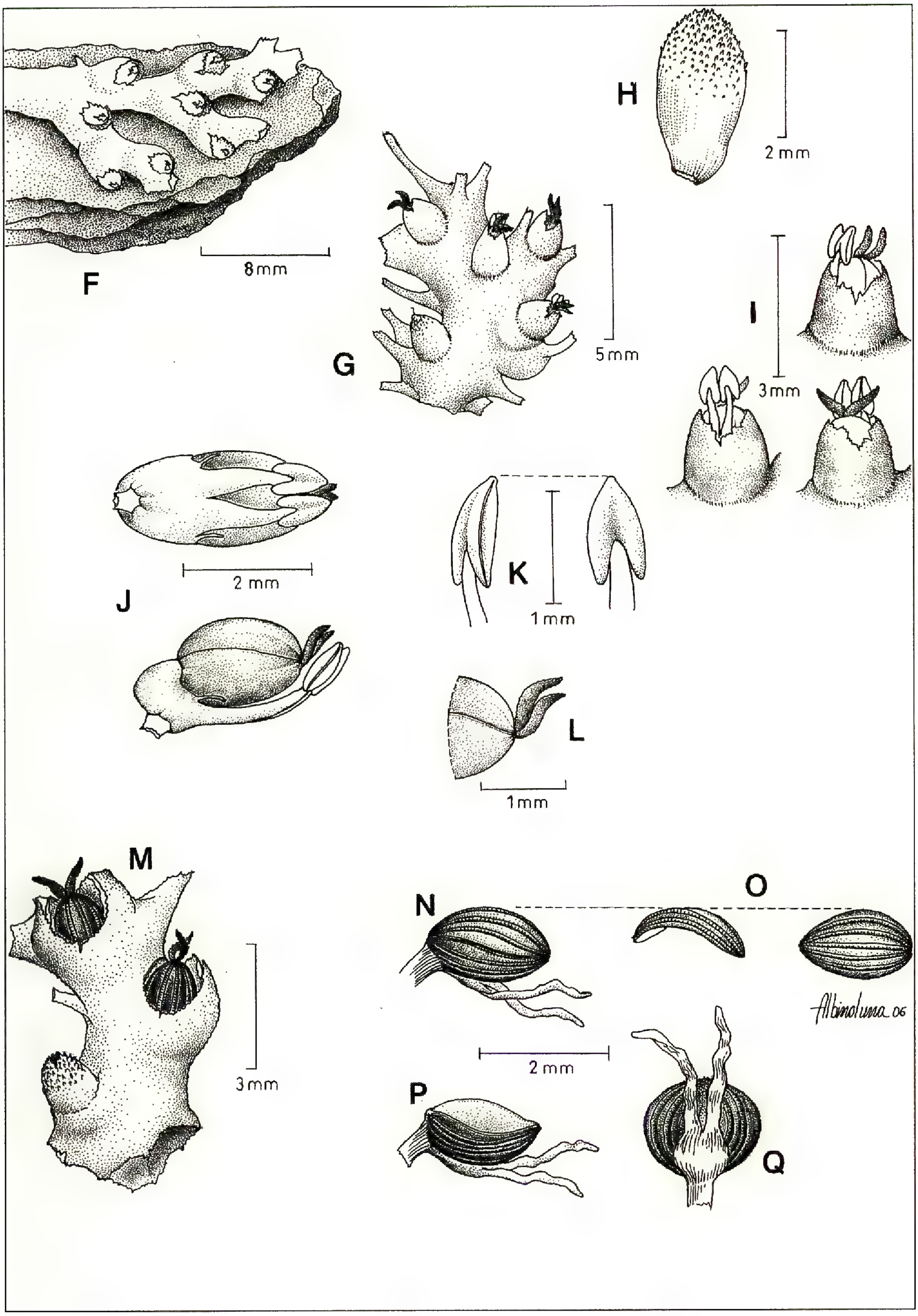

Figure 2. *Castelnavia noveloi* C. T. Philbrick & C. P. Bove. —F. General habit of plant after leaves have been shed showing branched prostrate stem and lateral flowers in stem pockets. —G. Portion of prostrate stem viewed from above showing five lateral flowers, four at anthesis. Note the ruptured spathellae apices and projecting stigmas and stamens. —H. Intact spathella showing prominent papillae on the apical region. —I. Details of three flowers at anthesis partially enclosed in ruptured spathellae. Top: lateral view of one stamen and two stigmas; bottom right: dorsal view of two divergent stigmas and two stamens; bottom left: ventral view of two stamens and portion of one stigma. —J. Preanthesis flower with spathella removed. Top: ventral view showing apex of pedicel, asymmetrically expanded receptacle, two stamens, two tepals, ovary and apices of two stigmas; bottom: lateral view showing apex of pedicel, asymmetrically expanded receptacle, one stamen, one tepal, ovary

oriented horizontally, rupturing apically or subapically into (5)7(11) linear to triangular segments, lower region remaining covered by stem tissue; tepals 2, hair-like, linear, (0.1)0.3(0.5) mm, one on either side of the fused stamen filaments, apex acute; stamens 2, filaments flattened, wider at base than apex, attached to anther in pocket-like area, prior to anthesis (0.9)1.4(1.9) × (0.6)0.8(1.2) mm, elongating and projecting from the ruptured spathella during anthesis, usually persisting in the ruptured spathella; anthers basifixed, triangular, thecae fused apically, anther apex blunt, dehiscing introrsely and longitudinally, (0.6)0.8(1) × (0.3)0.4(0.6) mm; pollen in monads, small, isopolar, oblate spheroidal, polar diam. (16.2)17.6(18.8) µm, equatorial diam. (17.5)19.1(20) µm, tricolpate, planaperturate, microechinate granulate, colpus long (9.7 × 0.2 µm), colpus membrane with conspicuous spicules, sexine ca. 0.6 µm, nexine ca. 0.8 µm; ovary 2-carpellate, unilocular, strongly anisolobous, dorsal (upper) carpel markedly smaller than ventral (lower) carpel, remaining inside spathella during and after anthesis, (1.3)1.8(2.6) × (0.9)1.1(1.6) mm; ovules (93)132(147), placentation axile, placenta thick. Stigmas 2, free, linear, papillose, offset toward one side of ovary apex, (0.1)0.4(0.6) mm long prior to anthesis, elongating to (0.7)1(1.6) mm during anthesis. Capsules oriented horizontally, partially covered by surrounding stem tissue, markedly anisolobous, (1.5)1.8(1.9) × (0.8)1.3(1.6) mm; dehiscing by 2 valves, upper (dorsal) valve deciduous, (1.1)1.6(1.9) × (0.7)0.9(1.2) mm, 5-ribbed (non-suture ribs), suture margins also appearing thickened and rib-like; lower (ventral) valve persistent, cup-like, (1.3)1.6(1.8) × (1)1.3(1.6) mm, 7-ribbed (non-suture ribs), suture margins also appearing thickened and rib-like; seeds orange-brown, obovate, (0.26)0.3(0.34) × (0.16)0.19(0.23) mm; (0)77(124) per capsule.

Distribution and IUCN Red List category. *Castelnavia noveloi* is known only from rio Taquarussu, east of the town of Taquarussu, Tocantins, Brazil. Two other species of Podostemaceae occur in the same habitat: *Monostylis capillacea* Tulasne and *Apinagia* Tulasne sp. *Castelnavia noveloi* is interpreted as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001); it is only documented from a ca. 2-km region of rio Taquarussu.

Etymology. *Castelnavia noveloi* is named in honor of Luis Alejandro Novelo Retana (1951–2006; MEXU) to acknowledge his important contributions to our understanding of the systematics of New World Podostemaceae. The authors' lives were both greatly enriched by their associations with Dr. Novelo.

Additional observations. *Castelnavia noveloi* is most similar to species in the genus that possess prominent, cylindrical, dichotomously to subdichotomously branched, prostrate stems with numerous flowers (section *Eucastelnavia* Tulasne & Weddell).

Three previously described species (*Castelnavia lindmaniana* Warming, *C. multipartita* Tulasne & Weddell, and *C. princeps* Tulasne & Weddell [including *C. cuneifolia* P. Royen]) possess these features (Table 1).

Castelnavia noveloi differs from the other three species in terms of the presence or absence of petiolar stems, the number of ribs on the capsule, and the presence or absence of papillae on the upper portion of the ovary (Table 1). The presence of stems arising from the leaf petiole is characteristic for *C. noveloi* but is not observed elsewhere in the genus. Prostrate stems attach to the substratum and give rise to mature pinnate leaves. In addition, stems arise from the petiole (petiolar stems) on over half (62%, N = 50) of the mature pinnate leaves. Although the overall structure of petiolar and prostrate stems is the same (e.g., dichotomously divided, numerous flowers), petiolar stems are unattached to the substratum and often curled in shape. Only simple leaves have been observed on petiolar stems. Petiolar stems are not known among other New World Podostemaceae.

Leaf characteristics also distinguish *Castelnavia noveloi* (Table 1). Leaves of *C. noveloi* and *C. lindmaniana* are pinnate. In the former, the rachis is broad and flattened. In contrast, both rachis and petiole of *C. lindmaniana* are round to oval. Leaves of *C. princeps* are irregularly lobed. (Although the type of *C. princeps* lacks leaves, subsequent collections possess complete, variably lobed leaves.) Leaves of *C. multipartita* may be simple; however, such an

←

and two stigmas. —K. Two views (left: lateral view; right: ventral view) of intact anther showing triangular shape and fused thecae. Suture location (introrse) is evident in lateral view. —L. Apex of a preanthesis ovary showing two curved stigmas. —M. Portion of prostrate stem viewed from above showing horizontally oriented capsules in pockets on stem, partially covered by stem tissue. —N. Lateral view of capsule showing oblique attachment of pedicel to ovary, smaller upper (dorsal) valve, larger (ventral) valve, and persistent stamen filaments. —O. Lateral (left) and dorsal (right) views of deciduous upper (dorsal) capsule valve. Note prominent longitudinal ribs. —P. Lateral view of dehisced capsule lacking smaller upper (dorsal) deciduous valve. Note two persistent stamen filaments. —Q. View of ventral side of dehisced capsule showing ribs, two persistent stamen filaments, and fused bases of filaments. Drawings based on the holotype, *C. T. Philbrick et al. 5830* (R).

Table 1. Diagnostic characters of *Castelnavia noveloi* and the three other species of *Castelnavia* that possess cylindrical, prostrate, dichotomously branched stems with many flowers.

Character	*C. noveloi*	*C. lindmaniana*	*C. multipartita*	*C. princeps*[1]
Petiolar stems	present	absent	absent	absent
Mature leaf type	pinnate	pinnate	simple[2]	variably lobed
Rachis type on pinnate leaves	flattened	round-oval	NA	NA
Capsule non-suture rib number: deciduous (dorsal) valve	5	0	5	3
Capsule non-suture rib number: persistent (ventral) valve	7	0	7	3
Papillae on upper region of deciduous (dorsal) capsule valve	absent	absent	present	absent

[1] *Castelnavia cuneifolia* is interpreted as a synonym of *C. princeps*.
[2] Leaf form of *C. multipartita* is unclear (see text).

interpretation is tentative, as the type material lacks complete leaves, and the species is known only from the type collection.

Capsules of *Castelnavia noveloi*, *C. multipartita*, and *C. princeps* possess prominent longitudinal ribs (Table 1). Ribs can occur along the suture margins (suture ribs) or distinct from the margin (non-suture ribs). In some species of *Castelnavia*, as well as other Podostemaceae, the degree to which the suture ribs develop can vary among capsules. In contrast, the non-suture ribs are prominent and their occurrence more consistent. There are five non-suture ribs on the smaller (dorsal), deciduous capsule valve of *C. noveloi* and *C. multipartita*. Three non-suture ribs occur on the smaller valve of *C. princeps*. The larger (ventral), persistent capsule valve is also ribbed: seven non-suture ribs occur in *C. noveloi* and *C. multipartita*, three in *C. princeps*. Although Royen (1954) reported three ribs on the deciduous valve of *C. lindmaniana*, our observations of the type materials indicate that capsules of this species lack ribs (smooth). Some species (e.g., *C. multipartita*) of *Castelnavia* possess prominent papillae on the upper region of the ovary and capsule. *Castelnavia noveloi* lacks such papillae (Table 1).

Key to Species of *Castelnavia* with Prostrate, Cylindrical, Branched Stems with Many Flowers

1a. Mature capsules lacking ribs; mature leaves pinnate, rachis circular to elliptical in cross section. . . . . *C. lindmaniana*
1b. Mature capsules distinctly ribbed; mature leaves simple, pinnate or irregularly lobed, if pinnate, rachis expanded and flattened.
2a. Smaller (deciduous, dorsal) capsule valve with distinct papillae along the upper portion; leaves simple . . . . . *C. multipartita*
2b. Smaller (deciduous, dorsal) capsule valve lacking papillae; leaves pinnate or irregularly lobed.
3a. Petioles of mature leaves lacking stems arising from them; mature leaves irregularly lobed, lacking a distinctly flattened rachis; capsules with 3 non-suture ribs on smaller (deciduous, dorsal) valve and 3 non-suture ribs on larger (persistent, ventral) valve . . . . . *C. princeps*
3b. Petioles of mature leaves with branched stems arising from them; mature leaves pinnate with a distinctly flattened rachis (young leaves often simple); capsules with 5 non-suture ribs on smaller (deciduous, dorsal) valve and 7 non-suture ribs on larger (persistent, ventral) valve . . . . . *C. noveloi*

Paratype. BRAZIL. **Tocantins:** Taquarussu, 8 km E of town along Rt. TO-030, rio Taquarussu, 10°18′21.4″S, 48°10′17.7″W, 390 m, 26 July 2006, *C. T. Philbrick, C. P. Bove & S. L. Tucci 6000* (R, WCSU).

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New Combinations in *Lychnis* (Caryophyllaceae) from Africa

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Abstract. New combinations in *Lychnis* L. (Caryophyllaceae) are proposed for the names of seven taxa occurring in the East and West African mountains. The taxa have previously been placed in *Uebelinia* Hochstetter, but recent molecular studies placed the group within *Lychnis*. The new combinations are: *L. crassifolia* (T. C. E. Fries) M. Popp, *L. kigesiensis* (R. D. Good) M. Popp, *L. kigesiensis* subsp. *ragazziana* (S. Ousted) M. Popp, *L. kiwuensis* (T. C. E. Fries) M. Popp, *L. kiwuensis* subsp. *erlangeriana* (S. Ousted) M. Popp, *L. rotundifolia* (Oliver) M. Popp, and *L. scottii* (Turrill) M. Popp.

Key words: Afro-alpine, Afro-montane, Caryophyllaceae, East Africa, *Lychnis*, *Uebelinia*, West Africa.

The latest revision of the Afro-montane and Afro-alpine genus *Uebelinia* Hochstetter was done by Ousted in 1985. In the revision Ousted synonymized West African *U. hispida* Pax and *U. nigerica* Turill, and East African *U. spathulifolia* Hochstetter ex T. C. E. Fries with *U. abyssinica* Hochstetter, erected *U. kigesiensis* R. D. Good subsp. *ragazziana* S. Ousted, and suggested the new combination *U. kiwuensis* T. C. E. Fries subsp. *erlangeriana* (Engler) S. Ousted. Furthermore, he considered *Agrostemma* L. to be the closest relative to *Uebelinia*. However, several phylogenies inferred from chloroplast DNA, nuclear ribosomal DNA, and low-copy nuclear DNA have shown that *Uebelinia* is closely related to the Moroccan endemic *Lychnis lagrangei* (Cosson) Cosson and to the Eurasian *L. flos-cuculi* L. (Oxelman & Lidén, 1995; Oxelman et al., 1997; Popp & Oxelman, 2004; Popp et al., in prep.). In a revision of the tribe Sileneae, Oxelman et al. (2000) included *Uebelinia* in *Lychnis*. A new combination for the type of the genus, *U. abyssinica* Hochstetter, was included in the publication, but new combinations for the names of the remaining species were omitted. Here I propose new combinations for the names of seven taxa, including five species and two non-autonymous subspecies.

1. **Lychnis crassifolia** (T. C. E. Fries) M. Popp, comb. nov. Basionym: *Uebelinia crassifolia* T. C. E. Fries, Repert. Spec. Nov. Regni Veg. 19: 91. 1923. TYPE: Kenya. Rift Valley/Central Province: Aberdare Mtns., *R. E. & T. C. E. Fries 2266* (holotype, UPS; isotypes, B, K, S not seen).
2. **Lychnis kigesiensis** (R. D. Good) M. Popp, comb. nov. Basionym: *Uebelinia kigesiensis* R. D. Good, J. Bot. 62: 332. 1924. TYPE: Uganda. Western Province, Kigezi District: Behungi, *E. & C. Godman 237* (holotype, BM).
3. **Lychnis kigesiensis** subsp. **ragazziana** (S. Ousted) M. Popp, comb. nov. Basionym: *Uebelinia kigesiensis* R. D. Good subsp. *ragazziana* S. Ousted, Bull. Jard. Bot. Belg. 55: 446. 1985. TYPE: Ethiopia. Shoa Province: Entotto, 2 Oct. 1886, *V. Ragazzi s.n.* (holotype, FT; isotype, FT).
4. **Lychnis kiwuensis** (T. C. E. Fries) M. Popp, comb. nov. Basionym: *Uebelinia kiwuensis* T. C. E. Fries, Repert. Spec. Nov. Regni Veg. 19: 90. 1923. TYPE: Rwanda. Pass betw. Sabinyo & Kahinga, *H. Humbert* 8647 (neotype, designated by S. Ousted, 1985: 452, B; isotypes, BR, G, P not seen).
5. **Lychnis kiwuensis** subsp. **erlangeriana** (S. Ousted) M. Popp, comb. nov. Basionym: *Uebelinia rotundifolia* Oliver var. *erlangeriana* Engler, Bot. Jahrb. 48: 381. 1912. *Uebelinia erlangeriana* (Engler) T. C. E. Fries, Repert. Spec. Nov. Regni Veg. 19: 89. 1923. *Uebelinia kiwuensis* T. C. E. Fries subsp. *erlangeriana* (Engler) S. Ousted, Bull. Jard. Bot. Belg. 55: 457. 1985. TYPE: Ethiopia. NE of Agere Selam, *I. Friis, M. G. Gilbert, F. Rasmussen & K. Vollesen 757* (neotype, designated by S. Ousted, 1985: 457, BR not seen; isotype, C).
6. **Lychnis rotundifolia** (Oliver) M. Popp, comb. nov. Basionym: *Uebelinia rotundifolia* Oliver, J. Linn. Soc., Bot. 21: 397. 1885. TYPE: Tanzania. Northern Province, Moshi Rural District, Mt. Kilimanjaro, Sep. 1884, *S. Thomson s.n.* (holotype, K).
7. **Lychnis scottii** (Turrill) M. Popp, comb. nov. Basionym: *Uebelinia scottii* Turrill, Kew Bull. 1954: 260. 1955. TYPE: Ethiopia. Gamo-Gofa Province: Gughé Highlands, Mt. Tola, *H. Scott 156* (holotype, K).

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Nueva Especie de *Calceolaria* (Calceolariaceae) del Centro del Perú

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Resumen. Se describe, ilustra y compara con sus parientes más cercanos una nueva especie de *Calceolaria* L. (Calceolariaceae) del centro del Perú: *Calceolaria oxapampensis* Puppo de la sección *Lehmannina* Pennell. La nueva especie habita en bosque primario entre los 2400–2800 m en el departamento de Pasco.

Abstract. A new species of *Calceolaria* L. (Calceolariaceae) from central Peru is described, illustrated, and compared with its closest relatives: *Calceolaria oxapampensis* Puppo of section *Lehmannina* Pennell. The new species occurs in primary forest between 2400 and 2800 m in Pasco department.

Key words: *Calceolaria*, Calceolariaceae, IUCN Red List, Pasco, Peru.

Calceolaria L. (Calceolariaceae) es un género ampliamente distribuido en el neotrópico, alcanzando su máxima diversidad en los Andes del Perú (Molau, 1988). Es característico por su morfología floral: corola bilabiada con labio inferior sacciforme y dos estambres (Molau & Sánchez, 1986).

En la última revisión del género llevada a cabo por Molau para *Flora Neotrópica*, *Calceolaria* quedó subdividida en tres subgéneros y 22 secciones. La mayoría de especies del trópico corresponden al subgénero *Calceolaria*, en tanto los subgéneros *Cheiloncos* (Wettstein) Pennell y *Rosula* (Descole & Borsini) Molau agrupan primordialmente a los taxa extratropicales (Molau, 1988).

Calceolaria oxapampensis Puppo fue recolectada en el Parque Nacional Yanachaga-Chemillén, ubicado en la provincia de Oxapampa en el departamento de Pasco. Este departamento está situado en la parte central del Perú, abarcando tanto la vertiente occidental como oriental de los Andes, y es objeto de recientes exploraciones por el equipo de investigadores del Herbario Oxapampa (HOXA).

Calceolaria oxapampensis Puppo, sp. nov. TIPO: Perú. Pasco: Oxapampa, Parque Nac. Yanachaga-Chemillén, 10°31′S, 75°20′W, 2800 m, 23 mar. 2003, *A. Monteagudo, G. Ortiz, C. Mateo & R. Francis 4804* (holotipo, HOXA; isotipo, USM). Figura 1.

Herba 40–60 cm alta, caulibus strigosis. Folia decussata, petiolata; lamina 2.5–8 × 1.1–4.5 cm, herbacea, elliptica, marginibus integris vel crenulatis, ad apicem acuta, glabriuscula, infra pinnato-venosa; petioli 7–25 mm, estrigosi. Bracteae adsunt. Sepala 6–9 × 3–5 mm, viridia, lanceolata, acuta, glabriuscula, marginibus dentatis; corola flava, labio inferiore 12–20 mm, recurvato; elaeophorum adest; antherae 2.3–3.1 mm, fuscae; thecae aequales, divaricatae vel leviter deflexae, totae dehiscentes; stylus 1.5–2 mm, erectus; stigma bilobum.

Hierba 40–60 cm alto; tallos erectos, marrón-estrigosos. Hojas simples, opuestas y decusadas, pecioladas; lámina 2.5–8 × 1.1–4.5 cm, membranácea, elíptica, marginalmente entera o inconspicuamente crenada, base redondeada o cuneada, de ápice agudo, glabrescente por ambas superficies, venación pinnatinervia, nervaduras pubérulas; pecíolos 7–25 mm, estrigosos. Inflorescencia terminal formada por dos pares de cimas; pedúnculos primarios 3.4–6.5 cm, estrigosos; pedicelos 8–28 mm con indumento similar al de los pedúnculos; brácteas 12–19 × 5–8 mm, similares a las hojas. Sépalos 6–9 × 3–5 mm, verdes, lanceolados, marginalmente dentados, de ápice agudo, glabrescentes o pubérulos por ambas superficies; corola amarilla, glandular-pubérula; labio superior 5 mm; labio inferior 12–20 mm, recurvado; garganta 5–6 mm de ancho, comosa; elaióforo presente; estambres con filamentos de 0.9–1.5 mm, algo villosos; anteras 2.3–3.1 mm, marrones, tecas iguales entre sí, divaricadas o ligeramente deflexas, totalmente dehiscentes, glabras, conectivo inconspicuo; estilo 1.5–2 mm, recto, estigma bilobado. Cápsulas globosas, 5–6 × 5–6 mm, densamente pubérulas.

Distribución y hábitat. *Calceolaria oxapampensis* habita en bosques primarios de la vertiente oriental de los Andes entre los 2400–2800 m y ha sido colectada únicamente en el Parque Nacional Yanachaga-Chemillén, por lo que sería endémica de esta zona. Debido a la humedad del hábitat, es frecuente encontrar musgo creciendo sobre los tallos de *C. oxapampensis* como se ilustra en la Figura 1.

Conservación. El Parque Nacional Yanachaga-Chemillén tiene una extensión de 1220 km² por lo que *Calceolaria oxapampensis* se encontraría en un estado de VU (Vulnerable) según el criterio B2a de la IUCN (2001).

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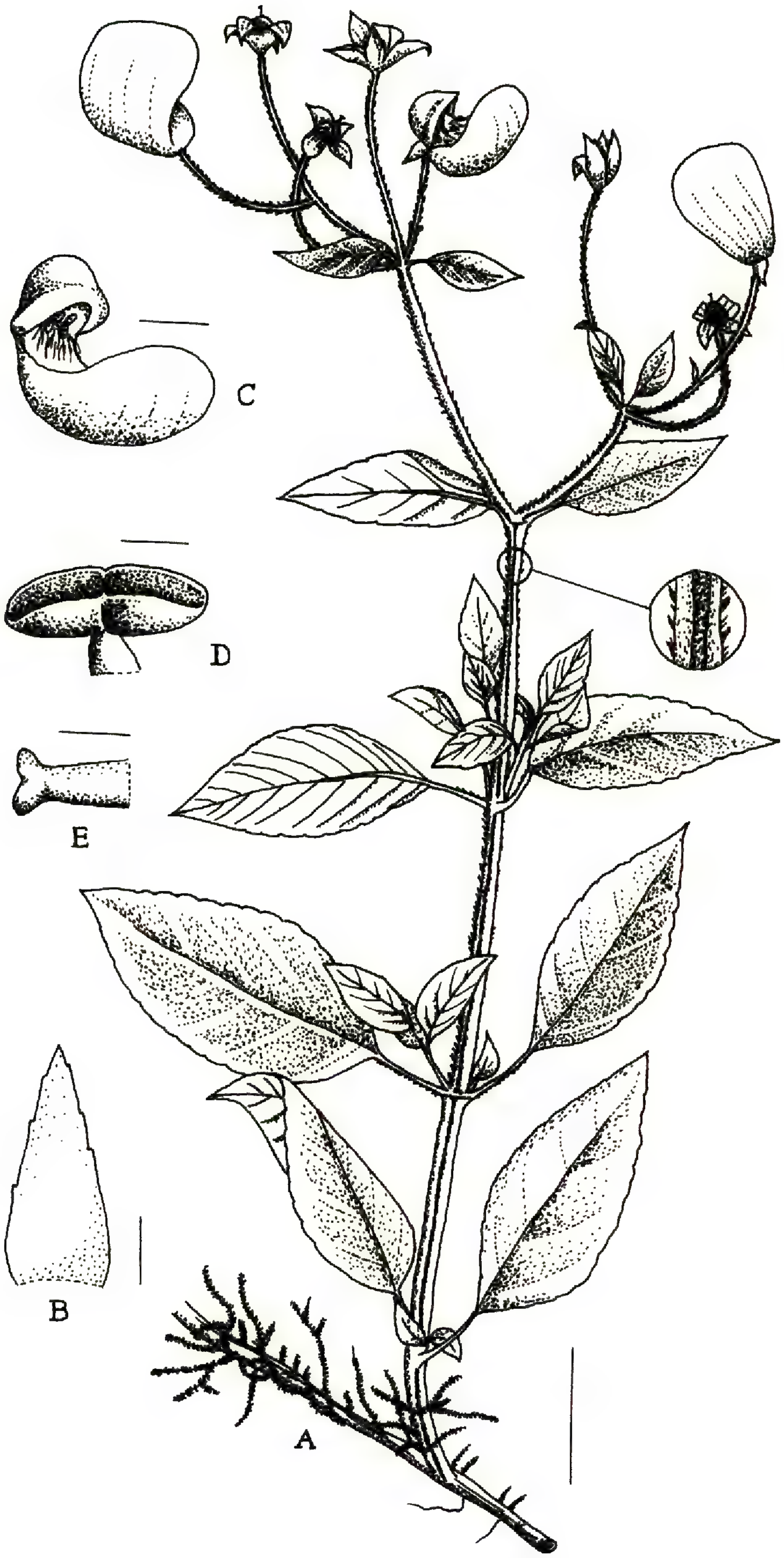

Figura 1. *Calceolaria oxapampensis* Puppo. —A. Rama con flores y musgo creciendo en la base. —B. Sépalo. —C. Corola. —D. Estambre. —E. Estilo. Escalas: A = 2 cm; B = 2 mm; C = 5 mm; D, E = 1 mm. Dibujado por el autor de material herborizado (holotipo, *Monteagudo et al. 4804*, HOXA).

Discusión. Por su hábito herbáceo y ascendente, sus hojas opuestas, decusadas, membranáceas y pecioladas, sus pedúnculos primarios largos y anteras totalmente dehiscentes, pero especialmente debido al tipo de indumento, *Calceolaria oxapampensis* se ubica en la sect. *Lehmannina* Pennell del subgénero *Calceolaria* (Molau, 1988) que ahora comprende 15 especies.

Calceolaria oxapampensis puede confundirse con *C. heterophylla* Ruiz & Pavón con la que se encuentra probablemente relacionada. *Calceolaria heterophylla* se caracteriza por sus tallos hirsutos, láminas foliares crasiúsculas notoriamente crenadas e hirsutas, brácteas ausentes en la inflorescencia, y sépalos ovados y enteros. *Calceolaria heterophylla* además habita en laderas con arbustos entre los 2000–3000 m, y está restringida a la provincia de Pachitea en el departamento de Huánuco.

Calceolaria luteocalyx Edwin, que presenta al igual que *C. oxapampensis*, sépalos dentados, corola con elaióforo y tecas divaricadas, se diferencia de esta última en que sus hojas son aserradas, pilosas en el haz e hirsutas al envés; sus sépalos amarillos de 9–15 mm long., y estilo curvo de 2.5–3.6 mm long. Además, *C. luteocalyx* es endémica del departamento de Amazonas.

Otra especie de la misma sección que también se distribuye en el centro del país es *Calceolaria vulpina* Kraenzlin. Esta especie se diferencia de *C. oxapampensis* por sus hojas crasiúsculas, hirsutas, marginalmente aserradas o biserradas, brácteas ausentes, sépalos enteros, glandular-hirsutos, anteras de 3.4–4.4 mm long., y estilo recurvado de 2.2–3 mm. *Calceolaria vulpina* habita en laderas rocosas entre los 3150–4200 m en los departamentos de Junín y Huancavelica.

Paratipos. PERÚ. **Pasco:** Oxapampa, P.N. Yanachaga-Chemillén, 10°32′S, 75°21′W, 16 mar. 2003, *R. Vásquez & R. Francis 28063* (HOXA, MO); 10°23′31″S, 75°28′29″W, 12 feb. 2004, *R. Vásquez, A. Monteagudo, A. Peña & R. Francis 29355* (HOXA).

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Two New Species of *Cerastium* (Caryophyllaceae) from the Equatorial Andes

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Abstract. *Cerastium* L. (Caryophyllaceae), predominantly a Holarctic genus also extending to temperate and montane regions of the Southern Hemisphere, is confined in the tropical Andes of South America to non-forest, high-altitude habitats. Two species of *Cerastium* from the subgenus *Eucerastium* (Boissier) Pax, *C. cuatrecasasii* Sklenář from the Sierra Nevada de Santa Marta in Colombia and *C. wilhelmianum* Sklenář from northern and central Ecuador, are described and illustrated. *Cerastium cacananense* Möschl is added to the list of the Peruvian species.

Resumen. *Cerastium* L. (Caryophyllaceae), un género predominantemente holártico que también se extiende a las zonas templadas y montañosas del hemisferio sur, en los Andes tropicales de América del Sur está restringido a los hábitats sin bosque de alta montaña. Se describen e ilustran dos especies nuevas de *Cerastium* del subgénero *Eucerastium* (Boissier) Pax, *C. cuatrecasasii* Sklenář de la Sierra Nevada de Santa Marta en Colombia y *C. wilhelmianum* Sklenář del norte y centro de Ecuador. *Cerastium cacananense* Möschl se añade a la lista de las especies peruanas.

Key words: Caryophyllaceae, *Cerastium*, Colombia, Ecuador, IUCN Red List, páramo, Peru.

Cerastium L. (Caryophyllaceae) is a widely distributed Holarctic genus that also occurs in temperate and montane regions of the Southern Hemisphere except Australia and New Zealand (Pax & Hoffmann, 1934; Bittrich, 1993). In the tropics and subtropics, the genus is mostly confined to non-forest habitats of mountainous regions such as the Andean cordilleras of South America (Baumann, 1988). About 20 species of *Cerastium* have been reported from the high equatorial Andes (Rohrbach, 1871–1873; Macbride, 1937; Brako & Zarucchi, 1993; Jørgensen & León-Yánez, 1999). However, specific limits among the taxa often remain unclear, and confusion exists about their geographic distribution. During my work on the revision of the family Caryophyllaceae for the *Flora of Ecuador*, I had the chance to examine herbarium material not only from that country, but also from adjacent Andean countries. I distinguished two new species of *Cerastium* from the subgenus *Eucerastium* (Boissier) Pax that are here described and illustrated. Also encountered was one species that represents an addition to the list of *Cerastium* species in Peru (Brako & Zarucchi, 1993).

Nomenclatural Novelties

1. Cerastium cuatrecasasii Sklenář, sp. nov. TYPE: Colombia. Magdalena: Sierra Nevada de Santa Marta, SE slopes, Hoya del Río Donachuí, Laguna de Calocribe (E of Meollaca), páramo, 3600–3700 m, 30 Sep. 1959, *J. Cuatrecasas & R. Romero Castaneda 24537* (holotype, F; isotype, NY). Figure 1.

Plantae perennes, deorsum hispidulae, sursum glandulosae; caulibus sterilibus brevibus, fertilibus adscendentibus usque erectis. Folia basalia subpetiolata, lamina anguste oblanceolata, hispidula; folia caulina sessilia, inferiora lamina anguste oblanceolata, hispidula, superiora lamina lanceolata, glandulosa. Inflorescentia 5- ad 13-flora, subcapitata vel subeffusa. Flos sepalis ovatis vel lanceolatis, glandulosis; petalis spathulatis, bilobatis, calycem superantibus; staminibus subaequalibus; ovario ovoideo.

Plants perennial, branched from the prostrate base, producing a few, short, sterile branches and ascending to erect, unbranched fertile stems to 30 cm tall, hispidulous below, glandular above. Basal leaves subpetiolate, densely clustered, marcescent, the base 9–11.3 × 1.2–2.1 mm, stramineous, hispidulous on the margins and on the midrib below, lamina narrowly oblanceolate, 14.3–29(–45) × 1.3–2.4(–4.7) mm, hispidulous, apex acute, cauline leaves sessile, the lower ones narrowly oblanceolate, 1.4–2.2 × 21–29 mm, hispidulous, the upper ones lanceolate, 16–22 × 2–5.2 mm, glandular. Inflorescence cymose, 5- to 13-flowered, subcapitate or ± open, erect; bracts lanceolate, 5.3–7.7 × 1.2–2.2 mm, glandular; pedicels slender, to 11 mm, glandular. Flowers conspicuous; sepals ovate or lanceolate, 4.7–7.5 × 1.3–2.1 mm, glandular, the margin membranous to 0.2 mm wide; petals white, spatulate, 9.5–12 ×

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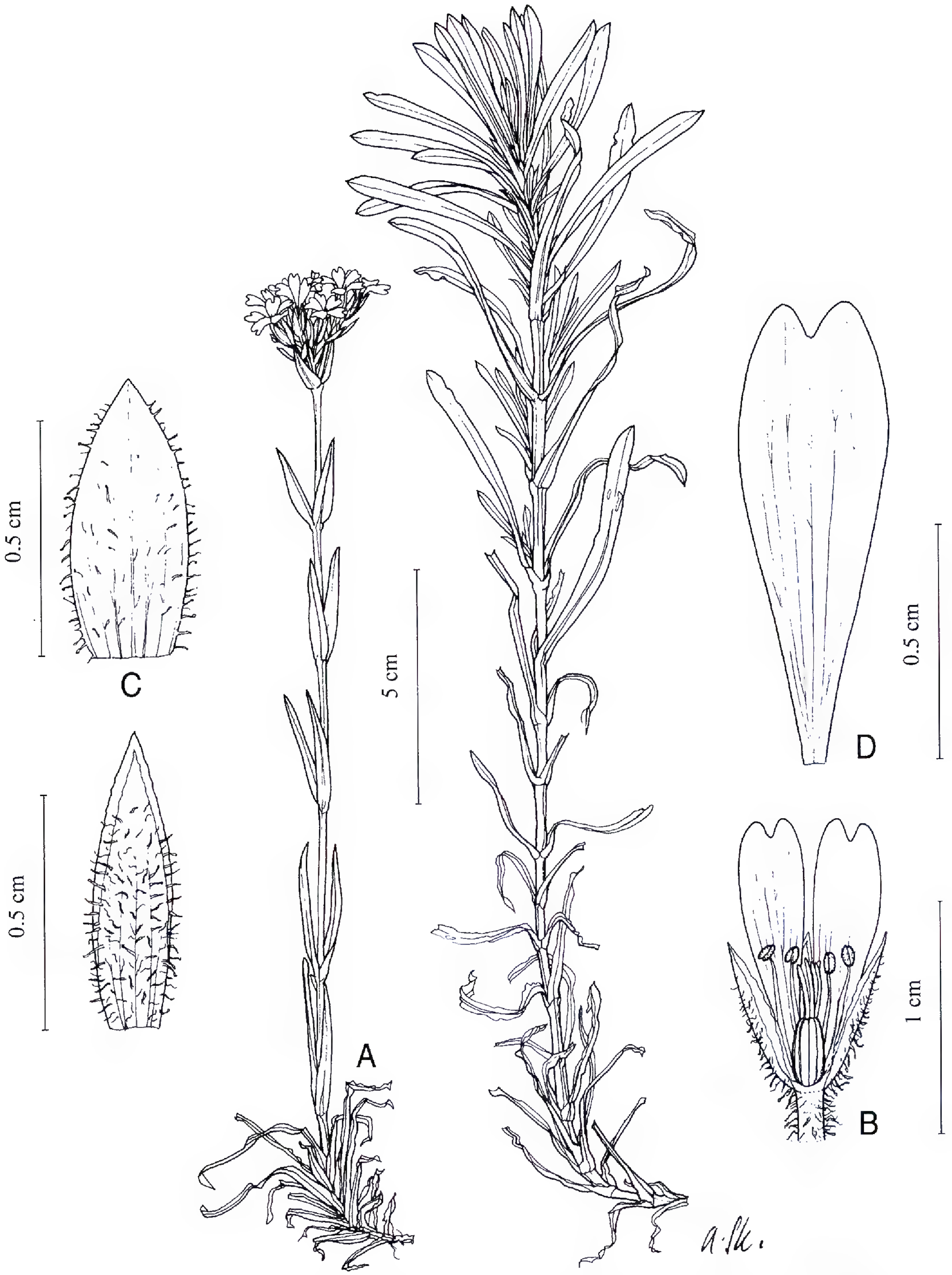

Figure 1. *Cerastium cuatrecasasii* Sklenář. —A. Habit. —B. Open flower with immature capsule. —C. Sepals. —D. Petal. (A, from *Cuatrecasas & Romero Castaneda 24583*; B–D, from the type *Cuatrecasas & Romero Castaneda 24537*.)

2.5–3.2 mm, bilobed, 4- to 7-nerved, petal lobes ca. 1.2 mm long and about as broad, obtuse, exceeding the calyx; stamens 10 in 2 rows, subequal; filaments 3.2–3.7 mm, anthers elliptic to oblong, 0.7–0.8 × 0.4–0.45 mm; ovary ovoid, ca. 1.5 × 2.5 mm; styles 5, ca. 1.7 mm; stigmas clavate. Capsule 5-valved, apparently opening with 10 teeth, not seen mature; mature seeds not seen.

Distribution, habitat, and IUCN Red List category. The species is only known from a few localities from the high altitudes (3600–4300 m) of the Sierra Nevada de Santa Marta in northern Colombia, and, as such, it is classified as Endangered (EN B2a) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The species is named after Don José Cuatrecasas (1903–1996), a dedicated explorer of the páramo flora who collected the type of this species.

Relationships. The young inflorescence of *Cerastium cuatrecasasii* can be compact but apparently opens during later development. Because of the compact younger inflorescence, these plants were earlier treated as *C. cephalanthum* S. F. Blake, a species that comprised Venezuelan páramo plants distinguished from other species mainly by the capitate inflorescence. However, the appearance of the inflorescence is a poor character to differentiate species of *Cerastium* and, until better knowledge is available, *C. cephalanthum* should be considered synonymous with an earlier-named Venezuelan species, *C. meridense* Linden & Planchon (= *C. venezuelanum* Briquet), type material (*Funck & Schlim 1149, 1642*; G, P) of which comprises plants with both compact (capitate) and open inflorescences. *Cerastium cuatrecasasii* is distinct from this species and from other Colombian and Venezuelan species by its oblanceolate basal leaves and by the hispidulous pubescence of the plant.

Paratypes. COLOMBIA. **Magdalena:** Sierra Nevada de Santa Marta, páramos around Laguna Naboba, Laguna Mamito & Laguna Mamo, 3 Oct. 1959, *J. Cuatrecasas & R. Romero Castaneda 24583* (F, NY); valley of Río Yebosimeina, 10°44′N, 73°39′W, 26 May 1977, *S. White & W. S. Alverson 598* (MO, NY, PRC).

2. Cerastium wilhelmianum Sklenář, sp. nov. TYPE: Ecuador. Imbabura: rd. from Laguna Cuicocha to Nevado Cotacachi, road bank & adjacent scrub vegetation, 3350 m, 00°18′47″N, 78°21′10″W, 11 Aug. 2004, *P. Sklenar 8261* (holotype, PRC; isotypes, AAU, MO, NY, QCA, QCNE). Figure 2.

Plantae verisimiliter perennes, conspicue glutinosae; caulibus sterilibus brevibus, caespitosis, fertilibus adscendentibus usque erectis, breviter ramosis, deorsum retrorsohispidis, eglandulosis, sursum glandulosis. Folia numerosa, deorsum densa, imbricata, anguste lanceolata, hispida et breviter glandulosa, sursum remota, breviora, glandulosa. Inflorescentia erecta, 5- ad 15-flora; pedicellis erectis strictis. Flos sepalis anguste ovatis vel lanceolatis, glandulosis; petalis spathulatis, bilobis; ovarioum ovoideo vel ellipsoideo. Capsula recta, exserta, usque ad 20 mm longa; seminibus conspicue conico-tuberculatis, tuberculis costatis.

Plants most probably perennial, 15–70 cm tall, caespitose, conspicuously glutinous except near base, the roots sparsely branched, exceeding 18 cm, to 2 mm diam.; basal sterile branches few, short, tufted; fertile stems 2 to 4, ascending to erect, sparsely branched, stramineous and fragile at nodes upon senescence, retrorse-hispid and eglandular below, diffusely glandular-pubescent above. Leaves numerous, sessile, the lower ones densely clustered and imbricate, narrowly lanceolate, 22–44 × 3–4 mm, acute, hispid and sparsely glandular, at anthesis drying and recurving from base upward, the margins somewhat revolute, the upper ones progressively more distantly spaced, smaller, glandular, flat. Inflorescence cymose, erect, 5- to 15-flowered, erect; bracts narrowly lanceolate, 5–13 × 1–1.8 mm, herbaceous, glandular; pedicels erect, straight, to 2.3 mm, glandular. Sepals narrowly ovate to lanceolate, 7.1–12.5 × 1.8–3.4 mm, acute, glandular, the inner ones with membranous margin to 0.3 mm wide; petals white, spatulate, 7.9–10.5 × 3.3–4.2 mm, shorter than to equaling sepals (rarely exceeding them), bilobed, lobes 1.4–1.8 × 0.7–1.3 mm, acute to obtuse; stamens 10, subequal; filaments 3–4.5 mm; anthers oblong, ca. 0.85 mm; ovary ovoid to ellipsoid, ca. 1.9 × 3.1 mm; styles 5 (rarely 7), 1.6–2.4 mm; stigmas clavate. Capsule straight, cylindric, exserted, enlarging to 20 × 3.7–4 mm, opening with 10 teeth, the teeth straight or slightly opening, 1.3–1.4 mm long; seeds numerous, ovate to triangular, 0.8 mm long, 0.55–0.6 mm diam., conspicuously conically tuberculate, the tubercles ca. 0.1 mm high and about as broad at the base, ridged.

Distribution, habitat, and IUCN Red List category. The species is known from northern and central Ecuador. It was collected on open soil along road banks and on poorly developed, coarse volcanic soils, at elevations from 3100 to 3850 m. The species seems to prefer relatively drier habitats. Because of its limited geographic distribution and small number of known localities, the species is classified as Vulnerable (VU B1a) according to IUCN Red List criteria (IUCN, 2001), although the number of localities may be underestimated due to insufficient exploration of the inter-Andean valley.

Etymology. The species is named after Wilhelm Möschl (1906–1980), an Austrian botanist who studied the genus *Cerastium* and described several species from South America, who seems to have intended to treat this as a distinct species as judged from his notes on some annotation labels, and whose determinations of Andean specimens provided illuminating insights for me during my early attempts to understand the specific limits among the Ecuadorian species of *Cerastium*.

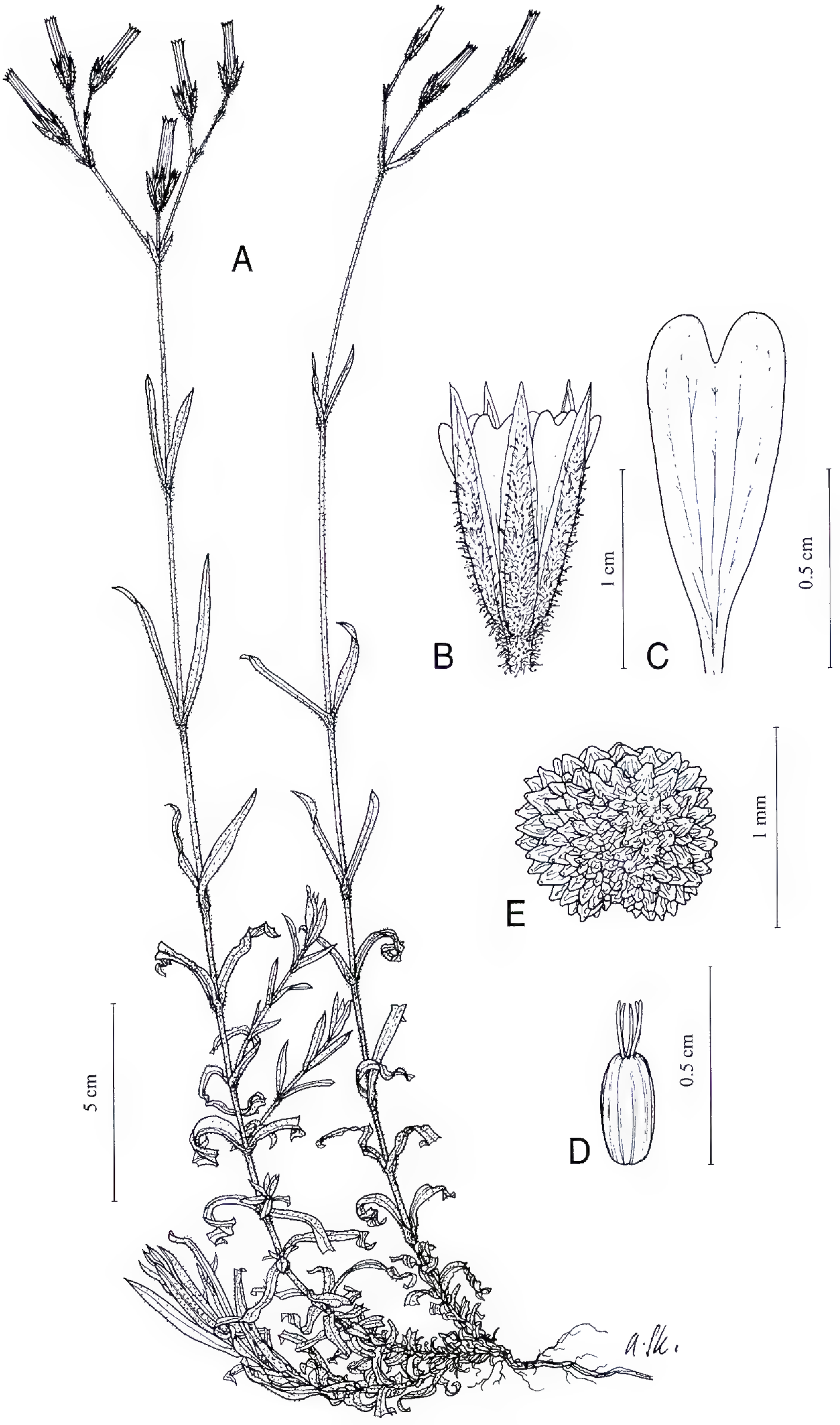

Figure 2. *Cerastium wilhelmianum* Sklenář. —A. Habit. —B. Flower. —C. Petal. —D. Mature ovary. —E. Seed. (A, E, from the type *Sklenar 8261*; B–D, from *Sklenar 7317*.)

Relationships. The habit of *Cerastium wilhelmianum* varies from low, rather tufted plants growing in extreme habitats of poorly vegetated pyroclastic soils around the Cotopaxi volcano in Ecuador to tall plants growing on developed soils in more sheltered habitats within the páramo belt. The erect and straight pedicels, large flowers with petals shorter than or equaling the sepals, and straight capsules are distinct

features that differentiate *C. wilhelmianum* from other habitally similar species in the region (e.g., *C. arvensiforme* Weddell has petals distinctly longer than sepals; *C. kunthii* Briquet is also glandular-pubescent, but its flowers are smaller, the petals are longer than sepals, and both pedicels and capsules are curved apically).

Certain variation in floral characters was observed in two specimens from the Laguna Cuicocha area in northern Ecuador. Whereas the petals usually do not exceed the sepals in this species, the petals are to 1.3 times as long as the sepals in one duplicate (deposited at PRC) of the collection *Sklenar 8239*. Nevertheless, the petals are shorter than the sepals in the remaining duplicates of this collection number (deposited elsewhere), and other characters of the plant are consistent with the diagnostic characters of the type specimen. Another deviation is found in the collection *Peñafiel et al. 640* (MO), where seven styles are present in the single developed flower on the voucher.

Paratypes. ECUADOR. **Cañar:** along a paved rd. to Carshao, 02°27′S, 78°59′W, 3250 m, 10 June 1999, *P. Sklenar & S. Lægaard 7128* (QCA, QCNE, PRC). **Chimborazo:** Panamerican Hwy., Riobamba–Alausí, N of Palmira, 02°01′S, 78°44′W, 29 Aug. 1984, *S. Lægaard 52724* (AAU). **Cotopaxi:** Cotopaxi Natl. Park, Limpiopungo, flat plain NW of Cotopaxi cone, 00°37′S, 78°28′W, 21 May 1988, *H. Balslev, G. Paz y Miño & S. S. Renner 69096* (AAU), *H. Balslev, G. Paz y Miño & S. S. Renner 69119* (AAU), *H. Balslev, G. Paz y Miño & S. S. Renner 69125* (AAU); Cotopaxi Natl. Park, Pampa de Limpios, 00°40′S, 78°30′W, 21 Nov. 1982, *M. Davila & H. Balslev 59* (QCA). **Imbabura:** Reserva Ecol. Cotacachi-Cayapas, Laguna de Cuicocha, Islote Yerovi, 00°18′N, 78°22′W, 22 Dec. 1991, *M. Peñafiel, F. Bersona, P. Gaibor & G. Toasa 640* (MO, QCNE); rd. from Laguna Cuicocha to Nevado Cotacachi, 00°19′14″N, 78°21′21″W, 11 Aug. 2004, *P. Sklenar 8239* (AAU, MO, QCA, QCNE, PRC). **Pichincha:** Pichincha, 30 Mar. 1930, *R. Benoist 2307* (P); Au-dessus de Paluguillo, 13 Feb. 1931, *R. Benoist 3892* (P); N side of Cotopaxi volcano, Canyon Colorado, 00°36′S, 78°24′W, 28 June 1999, *P. Sklenar 7317* (QCA, PRC), *P. Sklenar 7320* (PRC); NE side of Cotopaxi volcano, 00°36′S, 78°24′W, 26 June 1999; *P. Sklenar 7391* (QCA, QCNE, PRC).

Addition for Peru

Cerastium cacananense Möschl, Bol. Soc. Brot. Ser. 2. 31: [143], tab. 1, 2. 1957. TYPE: Peru. La Libertad: Cerro Cacanan, near Huamachuco, 3250 m, 26 Nov. 1936, *J. West 8104* (holotype, UC not seen; isotypes, GH, MO not seen).

During my visit to GH in 2001, I examined collections of *Cerastium* from northern Peru and came across a specimen that was very conspicuous by its retrorse-hirsute pubescence. I immediately suspected an undescribed taxon. It turned out later, however, that the plant was already described as *C. cacananense* Möschl (1957). This species is an addition to the list of *Cerastium* in Peru from which it was omitted (Brako & Zarucchi, 1993). So far only the type material is known.

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A New Species of *Ceratozamia* (Cycadales, Zamiaceae) from Veracruz, Mexico

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ABSTRACT. *Ceratozamia decumbens* (Zamiaceae, Cycadales) is newly described and illustrated. This species, endemic to Veracruz, has affinity with *C. morettii* Vázquez Torres & Vovides, but differs in leaf morphology and leaflet habit as well as in the microsporangiate and megasporangiate strobili and trunk. *Ceratozamia decumbens* is considered part of the *C. latifolia* species complex, which includes *C. latifolia* Miquel, *C. microstrobila* Vovides & J. D. Rees, *C. huastecorum* Avendaño, Vovides & Castillo-Campos, and *C. morettii*.

Key words: *Ceratozamia* species complex, Cycad, floristic refuges, IUCN Red List, Mesoamerica, Pleistocene, Zamiaceae.

During botanical explorations (1982) in the mountainous region of central Veracruz, Mexico, we discovered and collected an interesting *Ceratozamia* Brongniart in tropical subdeciduous rainforest, which we identified as belonging to the *C. latifolia* Miquel species complex (Vovides et al., 2004). The habitat of the new species lies within the Córdoba Pleistocene floristic refugium (Toledo, 1982) on the lower slopes of the Sierra Madre. This Pleistocene refuge, along with two others—the Los Tuxtlas refugium in southern Veracruz and the Sierra de Juárez in Oaxaca, form three secondary refugia where biota were protected from decreasing temperatures or precipitation (Toledo, 1982). Other cycad species have been reported from these three regions or their vicinities: *C. robusta* Miquel, *C. miqueliana* H. Wendland, *Dioon purpusii* Rose, *D. caputoi* De Luca, Sabato & Vázquez Torres, and *D. califanoi* De Luca & Sabato. In the nearby but more humid Cenozoic "Arc Refugium" of Wendt (1987), at its western extreme neighboring the Córdoba and Sierra de Juárez refugia, *D. spinulosum* Dyer, *D. rzedowskii* De Luca, A. Moretti, Sabato & Vázquez Torres, and *Zamia loddigesii* Miquel are found. This refugium spans the high rainfall areas of southern Veracruz, southern Tabasco, northern Oaxaca, and northern Chiapas and includes the cycads *C. becerrae* Pérez-Farrera, Vovides & Schutzman, *C. zoquorum* Pérez-Farrera, Vovides & Iglesias, another population of *C. miqueliana* and *Z. purpurea* Vovides, J. D. Rees & Vázquez Torres, and *Z. cremnophila* Vovides, Schutzman & Dehgan. There is a general consensus of opinion on the existence of areas with floristic and faunistic affinities of great age (refugia) in southern Mexico (Brown, 1976; Toledo, 1982; Wendt, 1987). During the past 40,000 years, tropical forests in Mexico have been disrupted and displaced due to climatic changes, with cycles of cold-dry, cold-wet, and warm-dry climates. It appears that *Ceratozamia* (*Cycadopodites*) was present in the Miocene flora of the southern Mexican region of Pichucalco, Chiapas (Palacios & Rzedowski, 1993), and in Cenozoic *Engelhardtia* Leschenault ex Blume forests in Oaxaca, which have a fossil pollen spectrum that is remarkably similar to the modern pollen spectrum (Rzedowski & Palacios, 1977).

Several individuals of the new species have been under cultivation at the Francisco Javier Clavijero Botanic Garden (JBC) since 1982. Further collections were made during 1993 by Terrence Walters (Montgomery Botanical Center) and collaborators and during 2002 by the second author. After closely

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examining living plants in the field and at the JBC, herbarium material, and reproductive structures and comparing these with its congeners and descriptions by Miquel (1848), especially of *Ceratozamia longifolia* Miquel and microsporophyll illustrations of forma *fuscoviridis* (Miquel) J. Schuster of *C. mexicana* var. *longifolia* J. Schuster (Schuster, 1932), we conclude that this species is new to science. The new species has affinities with *C. morettii* Vázquez Torres & Vovides. *Ceratozamia morettii* is found in a cloud forest habitat on steep slopes with humus-rich, grayish yellow, clay soil of volcanic origin on the transverse Mexican Neovolcanic mountain range or the "Eje Neovolcánico Transversal" (Toledo, 1982).

Ceratozamia decumbens Vovides, Avendaño, Pérez-Farrera & González-Astorga, sp. nov. TYPE: Mexico. Veracruz: 8 Apr. 2005, *S. Avendaño & G. Alducin 5706* (holotype, XAL; isotypes, HEM, MO). Figure 1.

Planta rupestris; caule hypogeo vel leviter epigeo, globoso vel cilíndrico, decumbens; folia (2)4(6), ascendentia vel descendentia, petiolo et rhachidi rectis vel arcuatis, foliolis 7- ad 19-jugatis, coriaceis, lanceolatis, subfalcatis, planis, apice symmetrico vel asymmetrico, articulis rubiginosis.

Rupicolous plants with globose to cylindrical trunks, partially or entirely subterranean, decumbent, branched, protected by reddish brown, persistent petiole bases and cataphylls, (9–)13.2(–20) cm long, (8–)10(–14) cm diam. (n = 5). *Leaf cataphylls* deltoid, stipulate, reddish brown, tomentose, 1.8–2.2 × 2.4–3.9 cm. *Leaves* (2 to)4(to 6), ascending to descending, pendulous in older mature plants, pinnate, vernation erect, reddish brown upon emergence, dark to olive green at maturity, forming an open crown, (70–)117 (–150) × (39–)55.9(–78) cm (n = 7); *petiole and rachis* linear to arching, terete with 2 parallel adaxial channels at level of leaflet articulations, unarmed or with few, distantly spaced, short stout prickles, pubescent at emergence, glabrous at maturity, petiole (22–)39(–69) cm (n = 7), base swollen, covered with beige tomentum, 1–2.6 cm wide, rachis (30–)49.8 (–93) cm (n = 6). *Leaflets* coriaceous, flat, 7 to 19 pairs, lanceolate, subfalcate, symmetrical or asymmetrical toward acuminate apex, leaflets wider and more asymmetrical in juvenile and young adult plants at times with a cleft toward apex, base attenuate, opposite to subopposite along apical and middle portion of leaf, alternate to subalternate along basal portion of leaf, margins subrevolute, entire, dark to olive green on adaxial surface, lighter green on abaxial surface, inserted flat, perpendicular to the rachis at proximal and middle portions of leaf, at slight angle toward distal portion, (21–)30.2(–38) × (2.4–)3.5(–4) cm (n = 11); *articulation* reddish brown becoming dark green at leaf senescence, (0.7–)0.79 (–1.1) cm wide (n = 8), (16 to)24(to 34) veins visible on adaxial surface (n = 14), intervein distance (0.1–) 0.15(–0.2) cm (n = 18), seedling eophylls 2, distance between leaflets (2.3–)3.8(–5) cm (n = 6). *Microstrobili* cylindrical, erect, green at emergence, dark green to light brown at maturity, (12–)15.5(–19) cm long, (2.3–)2.7(–3) cm diam. (n = 2); peduncle tomentose, light brown at emergence to brown at cone maturity, 2–14 cm long, 0.6–0.8 cm diam.; *microsporophylls* indeterminate, cuneiform, inserted spirally and perpendicular with respect to cone axis forming orthostichies, dark brown tomentulose, bicornate on distal surface, fertile portion covering 1/2 to 2/3 of abaxial surface excluding the horns, (0.9–)0.99(–1.2) × (0.6–)0.69(–0.8) cm (n = 8); horns straight to divergent, (0.2–)0.28(–0.4) cm, distance between horns (0.6–)0.67(–0.8) cm (n = 8); microsporangia numerous in sori of 2 to 3, dehiscence by longitudinal slit. *Megastrobilus* cylindrical or barrel-shaped, erect, olive green at emergence, dark green to brown at maturity, 11 cm long, 7.8 cm diam.; peduncle light beige tomentose, 3.8 cm long, 0.8 cm diam.; *cataphylls* long-triangular, stipulate, tomentose; *megasporophylls* indeterminate, peltate, spirally inserted along cone axis, (3.1–)3.3(–3.5) cm, including horns, distal face hexagonal to rhomboid, bicornate, dark metallic green with light beige tomentulum on margin, long axis (2.3–)2.5(–3.4) cm, short axis (1.1–)1.3(–1.5) cm (n = 6), horns diverging, (0.4–)0.6(–0.8) cm long, distance between horns (1.1–)1.2(–1.3) cm (n = 6). *Seeds* ovate-angulate, sarcotesta white when immature turning creamy beige to light brown at maturity, sclerotesta smooth, beige, with 8 to 12 visible rays radiating from the chalaza to the micropyle, (2.1–) 2.4(–2.6) cm long, (1.6–)1.7(–1.8) cm diam. (n = 6). Chromosome number $2n$ = 16 (this study).

Etymology. The specific epithet alludes to the decumbent nature of trunks in older mature plants.

Distribution and habitat. *Ceratozamia decumbens* is endemic on karstic hills in central Veracruz, Mexico. It grows on karstic rocks in subdeciduous tropical rainforest or bosque tropical subperennifolia sensu Rzedowski (1978) at an altitude of 712 m on shallow tropical rendzina soils. The more common tree species in the upper stratum of the forest at the type locality are: *Brosimum alicastrum* Swartz, *Bursera simaruba* Sargent, *Cedrela odorata* L., and *Ficus obtusifolia* HBK. Associated species in the herbaceous layer are *Begonia* L., *Jacobinia spicigera* L. H. Bailey, and the undergrowth palms *Chamaedorea elatior* Martius, *Chamaedorea tepejilote* Liebmann, and *Chamaedorea elegans* Martius. The climate of this

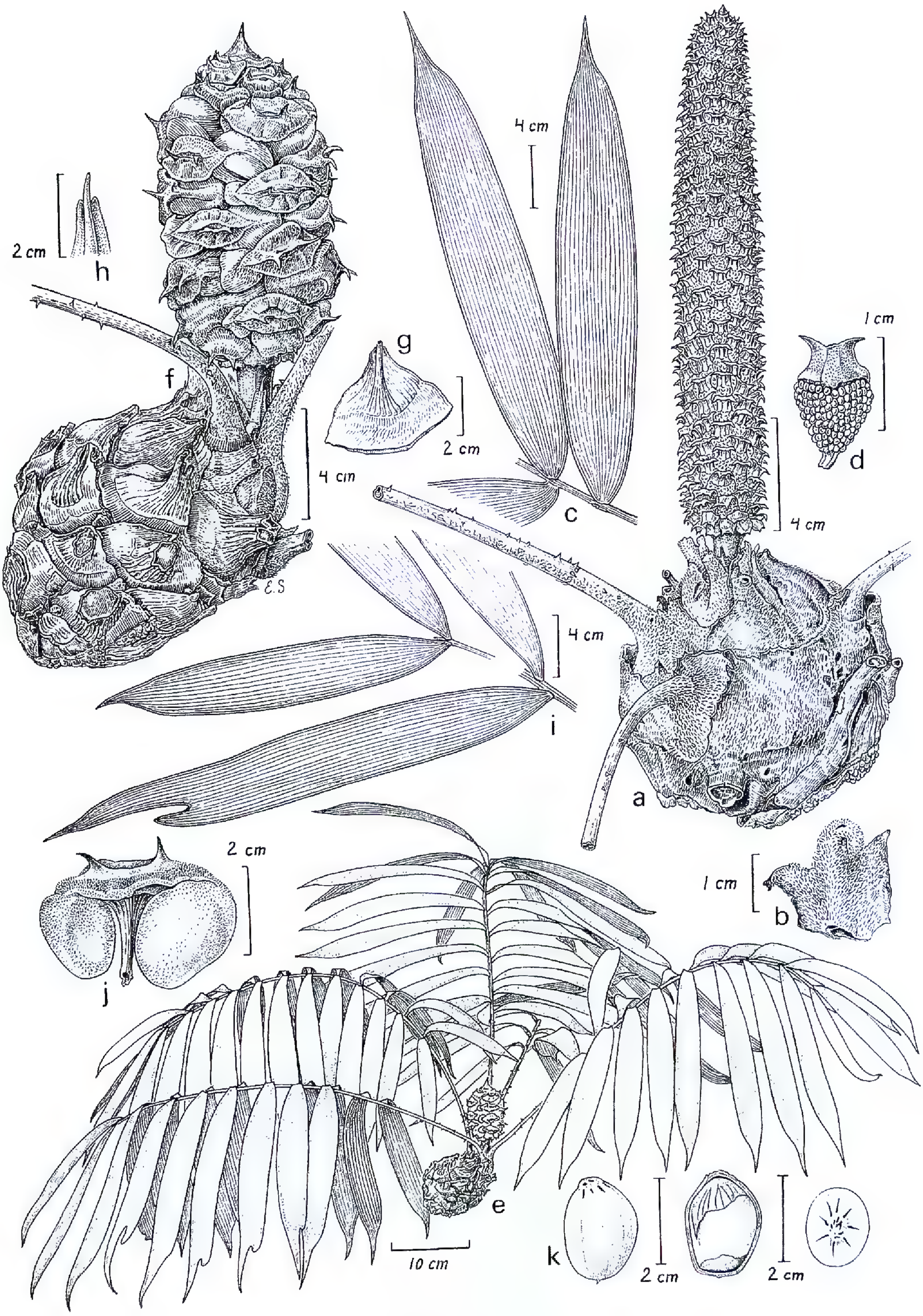

Figure 1. *Ceratozamia decumbens* Vovides, Avendaño, Pérez-Farrera & González-Astorga. —A. Mature microstrobilus attached to plant. —B. Detail of leaf cataphyll. —C. Midportion of leaf highlighting detail of articulation and leaflet veins. —D. Microsporophyll showing microsporangia. —E. Habit of female plant. —F. Detail of mature megastrobilus attached to plant. —G. Petiole base. —H. Detail of female cone cataphyll. —I. Distal portion of leaf highlighting leaflets and articulation. —J. Megasporophyll with two attached ovules. —K. Seed highlighting sclerotesta texture (left), split seed showing part of papery testa (center), and chalazal view (right). Drawn by Edmundo Saavedra from living collections at JBC (accession nos. 93-130.01 [female] and 82-439.02 [male]).

locality is semi-hot and subhumid with a total annual precipitation between 1000 and 1200 mm; it has a mean annual temperature of 21.5°C, a minimum extreme temperature of the coldest month ranging between 12°C and 13°C, and a maximum extreme temperature of the hottest month of more than 34°C. The climate cryptogram is (A)Cw_1 (Soto et al., 1996). Elements of evergreen rainforests that are tolerant of dry conditions such as *Cedrela odorata*, *Ceiba pentandra* (L.) Gaertner, *Cordia alliodora* (Ruiz & Pavón) Oken, *Dendropanax arboreus* (L.) Decaisne & Planchon, *Pithecellobium arboreum* (L.) Urban, and *Sapindus saponaria* L., which are present in this tropical subdeciduous forest, are indicative of a drier past that conforms to the secondary type refuge according to Toledo (1982).

Discussion. Miquel (1848) described a number of *Ceratozamia* species from Mexico, but specimens of the original material were not found and Stevenson and Sabato (1986) lectotypified Miquel's taxa by referring to the original descriptions. However, these descriptions are incomplete and do not include reproductive structures, nor are they supported by botanical illustrations. Upon examining Miquel's descriptions of *C. longifolia*, *C. intermedia* Miquel, and *C. latifolia*, we found that some leaflet measurements of Miquel's taxa coincided with our description, especially that of *C. longifolia*. The description of *C. longifolia* was based on plants cultivated at "Hort. Amstelaed" and the habitat is simply listed as "Hab Mexicum," and since no reproductive structures were included, we regard this description (Miquel, 1848, vol. 1, p. 40) as ambiguous. However, Schuster (1932) in his monograph (pp. 131–132) treated *C. longifolia* as *C. mexicana* var. *longifolia* (Miquel) J. Schuster and illustrated microsporophylls of forma *fuscoviridis* (Schuster, 1932: fig. 19Q–T). Upon comparing Schuster's microsporophyll illustrations with those of *C. decumbens*, we find differences in the shape of the sterile portion, the shape of the horns, and the extent of the fertile portion, which is greater in *C. decumbens*.

In view of our current knowledge of cycad biology and the general tendency of cycad species to be either endemic or restricted in distribution, we decided to treat this taxon as new based on the recommendations of Walters et al. (2004), where cycad descriptions should be based on population criteria taking into account ecological, edaphic, and topographical data as well as plant associations; ex situ cultivation in order to assess plasticity of discriminatory characters; and geographical and climatic data, distribution range, and profile, but withholding precise locality information that may jeopardize the species survival.

Relationships. *Ceratozamia decumbens* has affinity with *C. morettii*, but differs in leaflet shape and articulation, leaflet width and color, and megasporophyll color. There are also differences in the leaf crown that cannot be appreciated in herbarium vouchers. *Ceratozamia decumbens* typically has four and rarely to six leaves per crown with erect vernation, which are ascending to descending and pendulous in older plants, and is found in subdeciduous tropical forest on karstic soils. *Ceratozamia morettii* has up to 10 leaves, which are decurrent to prostrate with circinate vernation, and grows on volcanic soils in cloud forest habitat with frequent mists (Vázquez-Torres & Vovides, 1998). Comparing *C. decumbens* with the other dwarf, broad-leaflet ceratozamias, several basic differences are found. Both *C. zoquorum* Pérez-Farrera, Vovides & Iglesias and *C. becerrae* are found in distinct oreographic regions of Mexico and have oblong to oblanceolate leaflets with brown and olive green tomentulum, respectively, associated with the megasporophylls, whereas *C. decumbens* has lanceolate leaflets and light beige tomentulum associated with the megasporophylls, *C. huastecorum* Avendaño, Vovides & Castillo-Campos has ascending leaves with oblanceolate leaflets, armed petioles, and scarce grisaceous indument associated with the megasporophylls, and *C. microstrobila* Vovides & J. D. Rees has ascending leaves, unarmed petioles, lanceolate to long-elliptic leaflets, and greenish brown megastrobili with glabrous to scarce light brown tomentulum associated with the megasporophylls. The leaflets in *C. decumbens* and *C. microstrobila* are opaque, while those of *C. morettii* and *C. huastecorum* are translucent, enabling the veins to be visible when the leaflets are held up to a light source. The petiole in *C. decumbens* is unarmed or with few stout prickles, while in both *C. morettii* and *C. huastecorum* the petiole is heavily armed and that of *C. microstrobila* is unarmed (see Table 1).

A preliminary phylogeny of the genus *Ceratozamia* using nuclear ribosomal DNA ITS and chloroplast DNA *trnL-F* noncoding region has generated a consensus tree showing our new species (not attributed to species earlier) to be sister to a large clade that includes *C. morettii* and *C. mexicana* Brongniart, which grow in cloud forests on the transverse Mexican Neovolcanic mountain range (González & Vovides, 2002: *Ceratozamia* (1), fig. 5). This clade also includes a group of unresolved *Ceratozamia* species that lie to the north and northeast of this mountain range, which was interpreted as being the result of recent speciation following the amelioration of climates after the Pleistocene (González & Vovides, 2002). The presence of *C. decumbens* at the southern base of the transverse Mexican Neovolcanic mountain

Table 1. Comparative table separating *Ceratozamia decumbens* from *C. morettii*, *C. huastecorum*, and *C. microstrobila*.

Character	*C. decumbens*	*C. morettii*	*C. huastecorum*	*C. microstrobila*
Leaf vernation	erect	circinate	erect	erect
Leaflets	lanceolate	linear-lanceolate	oblanceolate	lanceolate to elliptic
Leaflet articulation	reddish brown	green	green	green
Megasporophyll	dark green	reddish brown	olive green	greenish brown
Megasporophyll indument	abundant, light beige	scarce, reddish brown	scarce, grisaceous	scarce, light brown
Seed length (cm)	2.1–2.6	1.5–1.8	1.2	1.8–1.9
Trunk shape	globose to cylindrical	globose to cylindrical	globose	ovoid to subcylindric
Petiole	unarmed or with few prickles	armed with short prickles	armed with short prickles	unarmed
Vein visibility when leaflet is held up to the light	not visible	visible	visible	not visible

range is particularly interesting, since it is within the Córdoba Pleistocene floristic refugium of Toledo (1982) and is sister to the taxa situated at and north of the transverse Mexican Neovolcanic mountain range, which appear to have been the product of a recent vicariance event (González & Vovides, 2002).

The recent speciation in cycads as a result of historical biogeographical effects has been related to the Pleistocene glaciations and floristic refugia and has been discussed for *Ceratozamia* by González and Vovides (2002) and for *Dioon edule* Lindley and *D. angustifolium* Miquel by González-Astorga et al. (2003a, b, 2005). Also, similar trends have been observed in other taxa such as *Pinus flexilis* E. James (Jørgensen et al., 2002) and *Lophocereus schottii* (Engelmann) Britton & Rose (Nason et al., 2002).

IUCN Red List category. *Ceratozamia decumbens* is native only to one karstic sierra in central Veracruz, Mexico. Specific locality information has purposely been omitted in order to discourage illegal commercial collecting of this critically endangered species. The removal of the herbaceous layer and undergrowth for the expansion of coffee plantations over recent years has severely affected the three known populations, and we estimate a total of less than 1000 individuals for these populations in a collective area of less than 10 km^2. We recommend an IUCN Red List category of Critically Endangered with very small or restricted populations (CR B2) (IUCN, 2001).

Paratypes. MEXICO. **Veracruz:** 31 May 2002, *S. Avendaño & A. Vázquez 5389, 5390, 5391, 5392, 5393* (MEXU, NY, XAL); 11 Sep. 1982, *J. D. Rees & A. P. Vovides 1690, A. P. Vovides 751* (XAL); 31 Oct. 2001, *A. Rincón 2798* (XAL); 10 Oct. 1993, *T. Walters 3–1, 3–5* (FTG, XAL).

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A New Species of *Bolbitis* (Bolbitidaceae) from Hainan, China

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ABSTRACT. During preparation of the account of Bolbitidaceae for the *Flora of China*, it was noticed that specimens of *Bolbitis* Schott, collected from Hainan Island, China, differed from other known species in Bolbitidaceae. This species, *Bolbitis changjiangensis* F. G. Wang & F. W. Xing, is herein described and illustrated as new. Its affinities and differences with the related species are discussed. This new species differs from its congeners by having a short erect rhizome; lateral pinnae in two to four pairs, without spines in the sinuses; and dimorphic fertile leaves. SEM observation of the spores of the new species and *B. subcordata* (Copeland) Ching shows distinct difference in spore morphology.

Key words: Bolbitidaceae, *Bolbitis*, China, Hainan, IUCN Red List.

The genus *Bolbitis* was established by Schott (1834–1836) for taxa in *Acrostichum* L. with a creeping rhizome and anastomosing veins. *Bolbitis* had been placed in Dryopteridaceae (Tryon & Tryon, 1982), Dennstaedtiaceae (Holttum, 1954), Lomariopsidaceae (Ching et al., 1964; Hennipman, 1977; Tsai & Shieh, 1994), and Bolbitidaceae (Ching, 1978; Wang, 1999). This is a pantropical genus of ca. 44 known species (Holttum, 1954; Hennipman, 1977; Tryon & Tryon, 1982; Wang, 2006). There are ca. 25 species in China, most distributed in southern and southwestern China (Wang, 1999; Dong & Zhang, 2005).

During the recent survey in Hainan for the Bolbitidaceae for the *Flora of China* treatment, Volume 3, several species of the family were collected and studied, one of which was a large fern forming an extensive population on sandy soil in deep shade near the Nancha River. This appears to be an unrecorded species and is described below.

Bolbitis changjiangensis F. G. Wang & F. W. Xing, sp. nov. TYPE: China. Hainan: Changjiang Co., Bawangling Nat. Reserve, Nancha River, 19°06′N, 109°04′E, 500–600 m, 14 July 2004, *F. G. Wang 051* (holotype, IBSC; isotypes, CANT, MO). Figures 1–3.

Species *Bolbitidi subcordatae* (Copeland) Ching similis, sed rhizomatibus erectis, sparse paleaceis; pinnis lateralibus 2- ad 4-jugis, alternis, sinubus pinnarum sine spinis; pinnis terminalibus longe flagelliformibus, perisporiis dense atque irregulariter cristato-undulatis alis gracilibus differt.

Terrestrial, to 111 cm tall; rhizome short, erect, 2–4 × 0.4–1 cm, with 2 or 3 rows of leaves, sparsely covered with lanceolate, subclathrate, brown or blackish scales; scales lanceolate or spatulate, 4–5 × 2.5–3 mm, dark brown or blackish brown, acuminate, margin sparsely dentate on upper part, subclathrate. Leaves close together, pinnate, thickly chartaceous; sterile leaves pinnate, 70–90 cm; petiole 32–51 cm, stramineous, sparsely scaly or glabrous near base; lamina oblong or ovate-oblong, 36–55 × 24–29 cm, with 2 to 4 pairs of lateral pinnae; lateral pinnae alternate, narrowly oblong-lanceolate, 17–19 × 3.5–4.6 cm, base asymmetric, rounded to truncate, margin usually slightly crenate, without spines in the sinuses, apex long-flagellate; pinnae with 0.1–0.4 cm long petiolule; terminal segment ± conforming to the lateral pinnae, longer than the remaining lamina, somewhat more deeply incised than central pinnae, 25–30 × 2.5–4 cm, apex long-flagellate, usually with a bud below the tip; costae prominent abaxially and adaxially, the lateral veins slightly prominent and with sparse scales; venation pattern with veins forming a costal areole and several to many distal areoles, the veins toward the margin free, excurrent, areoles with one or usually more, or irregular excurrent veinlets; fertile leaves dimorphic; most fertile leaves narrower than sterile leaves, 85–112 cm long, with 2 or 3 pairs of lateral pinnae; lateral pinnae 7–8 × ca. 1.5 cm, obtuse to acuminate, terminal segment 12–13.5 × 1.5–1.8 cm, base asymmetric, rounded to truncate. Sporangia inserted usually all over the abaxial surface, the arrangement acrostichoid, additionally, sporangia inserted on the abaxial surface of contracted pinnae in sterile leaves, the arrangement acrostichoid. Spores monolete, ellipsoid, perispore cristate-undulate, with dense, irregular and thin wing.

Ecology. *Bolbitis changjiangensis* is found on sandy soil near the Nancha River in evergreen seasonal rainforest, in humid and shady conditions, and in association with the ferns *Cyclosorus parasiticus* (L.) Farwell, *Neottopteris nidus* (L.) J. Smith, *C.*

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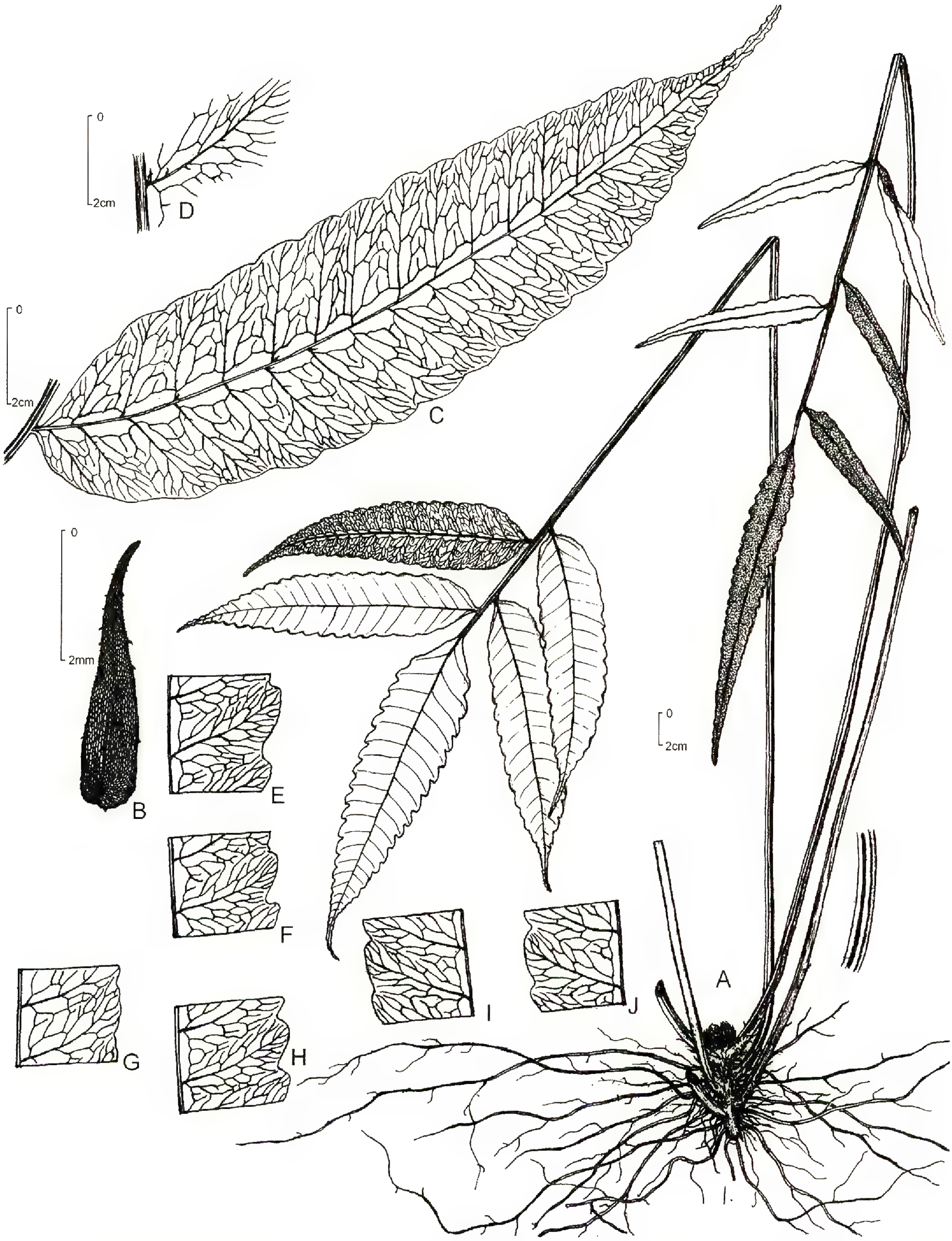

Figure 1. *Bolbitis changjiangensis* F. G. Wang & F. W. Xing. —A. Habit. —B. Enlarged scale. —C. Pinna. —D. Scales along the lateral vein. —E–J. Different patterns of veinlets. Drawn from the holotype *F. G. Wang 051* (IBSC) by Yun-xiao Liu.

latipinnus (Bentham) Tardieu, *Asplenium unilaterale* Lamarck, *Diplazium tomitaroanum* Masamune, *Pseudocyclosorus ciliatus* (Bentham) Ching, and *Phymatosorus hainanensis* (Nooteboom) S. G. Lu, and seed plants such as *Ficus hirta* Vahl, *Rubus reflexus* Ker Gawler, *Ardisia quinquegona* Blume, *Elaeocarpus sylvestris* (Loureiro) Poiret, *Schefflera arboricola* (Hayata) Merrill, *F. auriculata* Loureiro, *Melastoma dodecandrum* Loureiro, and *Dianella ensifolia* (L.) DC.

Figure 2. *Bolbitis changjiangensis* F. G. Wang & F. W. Xing. —A. Habit. —B–D. Fertile pinnae. Drawn from the paratype *F. G. Wang 053* (IBSC) by Yun-xiao Liu.

IUCN Red List category. *Bolbitis changjiangensis* is known from only one site in Hainan, and the population there is small, consisting of about 100 individuals. As such, it should be considered Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001; Hu et al., 2003). Additional biological and breeding studies should be taken toward effective conservation measures.

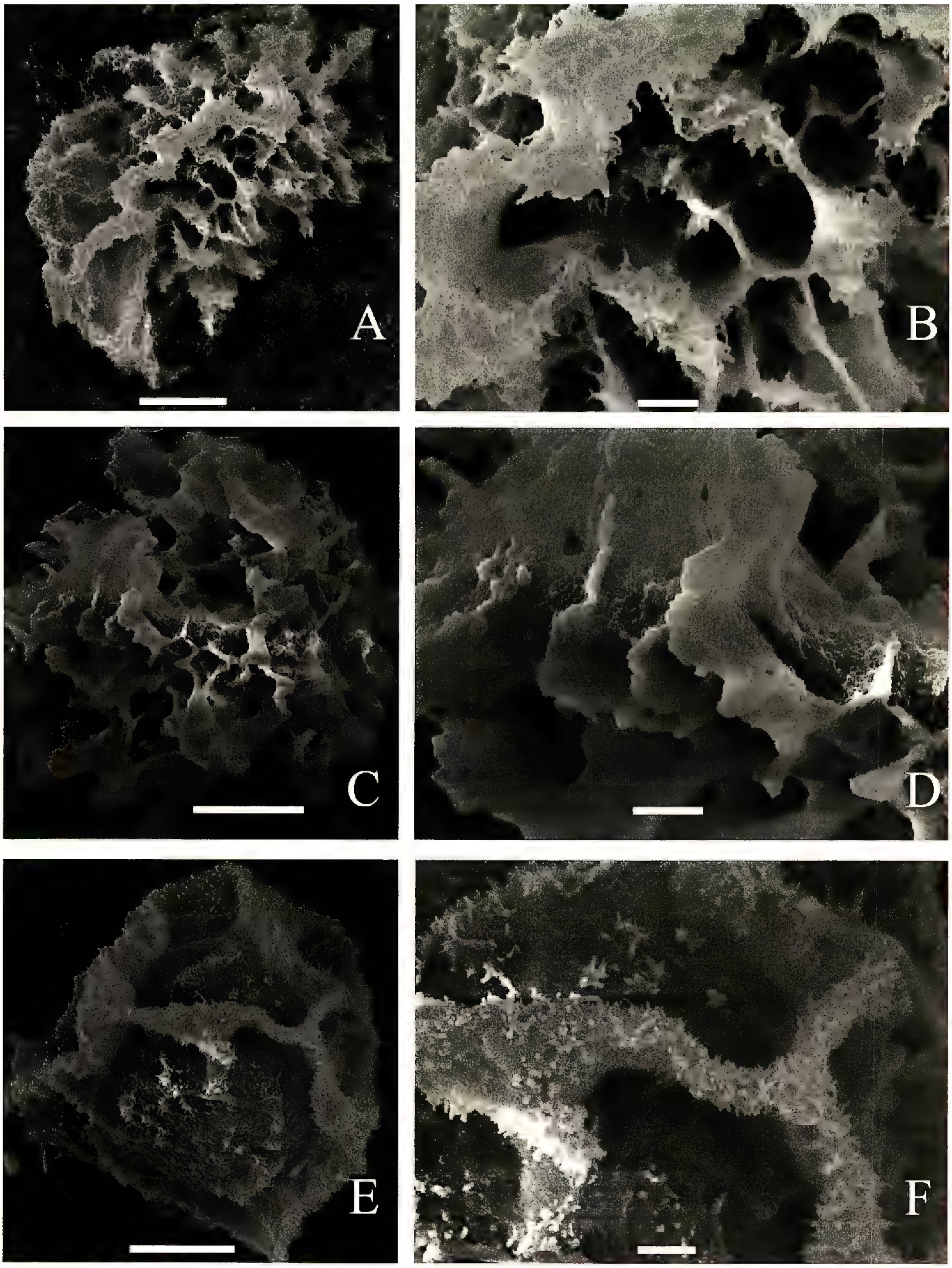

Figure 3. SEM photographs of *Bolbitis* spores. —A, B. *B. changjiangensis* (spore from the holotype *F. G. Wang 051* [IBSC]: A, ×1600, scale bar = 10 μm; B, ×6000, scale bar = 2 μm). —C, D. *B. changjiangensis* (spore from the paratype *F. G. Wang 053* [IBSC]: C, ×1900, scale bar = 10 μm; D, ×7000, scale bar = 2 μm). —E, F. *B. subcordata* (spore from *F. G. Wang 102* [IBSC], Diaoluo Mountain, Hainan, 18 July 2004: E, ×1900, scale bar = 10 μm; F, ×6000, scale bar = 2 μm).

Relationships. *Bolbitis changjiangensis* is closely related to *B. subcordata*, with which it shares certain morphological characteristics (Table 1). The spore morphology of *B. subcordata* differs from *B. changjiangensis* in that its perispores have fewer, thicker, and regular cristate to undulate wings (Fig. 3). *Bolbitis changjiangensis* is endemic to Bawang Ling, Hainan, whereas *B. subcordata* has a much wider

Table 1. Diagnostic characters of *Bolbitis changjiangensis* and similar species.

Character	*B. changjiangensis*	*B. subcordata*	*B. heteroclita*
Rhizome	short, erect, 2–4 cm tall, 0.4–1 cm thick, sparsely covered with scales	long, creeping, 10–15 mm thick, densely covered with scales	long, creeping, 10–15 mm thick, densely covered with scales
Scales of sterile leaves	sparsely scaly or glabrous near base	densely scaly near base	densely scaly near base
Leaf texture	thickly chartaceous	herbaceous	thinly herbaceous
Lateral pinnae	2 to 4 pairs, alternate; without spines in the sinuses, margin usually slightly crenate, apex long-flagellate	usually 6 to 12 pairs, alternate above, but opposite below the middle; margin with deep undulant lobes, with a prominent tooth in each sinus between the lobes, apex acuminate	1 to 4 pairs, alternate; margin usually ± entire or sinuate-serrate, rarely with a few setaceous teeth, apex long-flagellate
Terminal pinnae	base rounded to truncate, usually none divided	base truncate, divided	base truncate, none divided
Veinlets of pinnae	areoles forming 1, or usually more, or irregular included veinlets	with or without included veinlets	without included veinlets

distribution, from Japan (southern Kyushu, Ryukyu Island) and China (Fujian, Guangdong, Guangxi, Hainan, Hong Kong, Jiangxi, Taiwan, Yunnan, Zhejiang) to Vietnam (Tonkin, Annam) (Hennipman, 1977; Wang, 1999).

Bolbitis heteroclita (Presl) Ching, distributed in southern and southeastern Asian tropics, also resembles *B. changjiangensis* in having fewer pinnae (1 to 4 pairs) but is distinguished from the new species by its long, creeping rhizome and its leaves to 1 cm apart, with margin usually more or less entire or sinuate-serrate, rarely with a few setaceous teeth, with regular veinlets in three rows between lateral veins, and the terminal segment of the lamina generally somewhat to considerably larger.

Paratype. CHINA. **Hainan:** Changjiang Co., Bawangling Nat. Reserve, Nancha River, 500–600 m, 14 July 2004, *F. G. Wang 053* (IBSC).

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A New Species and Three Generic Transfers in the Fern Genus *Notholaena* (Pteridaceae)

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ABSTRACT. Three species of farinose ferns traditionally included in the large, polymorphic genus *Cheilanthes* Swartz are transferred to the genus *Notholaena* R. Brown as *N. aureolina* Yatskievych & Arbeláez, *N. jaliscana* Yatskievych & Arbeláez, and *N. ochracea* (Hooker) Yatskievych & Arbeláez. Additionally, a Central American novelty is described as a new species, *N. montielae* Yatskievych & Arbeláez, with a type from Nicaragua.

Key words: *Cheilanthes*, cheilanthoid ferns, Honduras, IUCN Red List, Nicaragua, *Notholaena*, Pteridaceae.

The genus *Notholaena* R. Brown (Pteridaceae subfam. Cheilanthoideae) was monographed by Tryon (1956) as comprising 58 species of New World ferns. Tryon and Tryon (1982) reclassified several of these species as members of the large aggregate genus *Cheilanthes* Swartz, leaving *Notholaena* with 39 species in two morphologically well-defined, informally recognized subgroups. Later cytological and morphological studies by Windham (1987) clarified the relatively distant taxonomic relationship between these groups within Pteridaceae and resulted in the segregation of 16 of Tryon and Tryon's species into a new genus, *Argyrochosma* (J. Smith) Windham. Other minor taxonomic shifts and the naming of several novelties have resulted in a circumscription of *Notholaena* to include about 30 species, 24 of which occur in Mexico (Mickel & Smith, 2004). Molecular studies (Gastony & Rollo, 1995, 1998; Kirkpatrick, 2007; Schuettpelz et al., 2007; Rothfels et al., in press) have confirmed that the two groups of New World species traditionally included in *Notholaena* should be treated as separate, distantly related genera within the Pteridaceae.

The use of the generic epithet *Notholaena* for this group of American species was stabilized by Yatskievych and Smith (2003). Previously, some European authors had advocated the application of the name to a distantly related suite of Old World taxa based on a different interpretation of the generic lectotype (Pichi Sermolli, 1983, 1989). More recently, Rothfels et al. (in press) have provided additional support for retention of the New World type for *Notholaena*.

Phylogenetic analyses of sequence data also have provided preliminary evidence that several additional species previously classified in the large polyphyletic genus *Cheilanthes* are part of the *Notholaena* clade (Gastony & Rollo, 1995, 1998; Schuettpelz et al., 2007; Rothfels et al., in press). Among these are three Mexican taxa characterized by relatively well-developed pseudoindusia and yellow-farinose abaxial blade indument. Recognition that they are anomalous within *Cheilanthes* already had led some authors (Ching, 1941; Yatskievych, 1995a) to treat some of these species within *Aleuritopteris* Fée, a segregate genus of mostly white-farinose, tropical and warm-temperate species taxonomically most diverse in portions of Africa and Asia. Within the major lineage of cheilanthoid ferns characterized by a base chromosome number of $x = 30$, production of a farina is characteristic of various subclades but is unknown in *Cheilanthes*, except for the three anomalous taxa in question, one or two as yet unstudied African species (*C. mossambicensi* Schelpe, *C. welwitschii* Hooker ex Baker) with orangish yellow farina, and in *Aleuritopteris*. Molecular data support the segregation of both *Aleuritopteris* and *Notholaena* from *Cheilanthes*, but the three yellow-farinose Mexican taxa traditionally placed in *Cheilanthes* are associated with the *Notholaena* lineage rather than *Aleuritopteris* (Gastony & Rollo, 1995, 1998; Schuettpelz et al., 2007). In fact, the most recent molecular phylogeny of the group (Rothfels et al., in press) indicates that *Cheilanthes aurantiaca* (Cavanilles) T. Moore, *C. aurea* Baker, and *C. palmeri* D. C. Eaton are nested within *Notholaena*. Accordingly, we transfer these taxa from *Cheilanthes* to *Notholaena*. The species epithets already are occupied in that genus, resulting in the need for replacement names:

Notholaena aureolina Yatskievych & Arbeláez, nom. nov. Replaced name: *Cheilanthes aurea* Baker in Hooker & Baker, Syn. Fil. 453. 1868. TYPE: Guatemala. 1862, *O. Salvin & D. Godman s.n.* (holotype, K).

Transfer of *Cheilanthes aurea* to *Notholaena* is blocked by the existence of *N. aurea* (Poiret) Desvaux

(Desvaux, 1827), which is a synonym of *C. bonariensis* (Willdenow) Proctor.

Notholaena jaliscana Yatskievych & Arbeláez, nom. nov. Replaced name: *Cheilanthes palmeri* D. C. Eaton in Proc. Amer. Acad. Arts 22: 464. 1887. *Cheilanthes aurea* Baker var. *palmeri* (D. C. Eaton) Mickel in Mickel & Smith, Mem. New York Bot. Gard. 88: 185. 2004. TYPE: Mexico. Jalisco: Guadalajara, July 1886, *E. Palmer 223* (holotype, YU; isotypes, GH, MO, NY, YU).

Transfer of *Cheilanthes palmeri* to *Notholaena* is blocked by the existence of *N. palmeri* Baker (Baker, 1887), which is a synonym of *Argyrochosma palmeri* (Baker) Windham.

Notholaena ochracea (Hooker) Yatskievych & Arbeláez, comb. nov. *Allosorus ochraceus* Hooker in Bentham, Pl. Hartw. 55. 1840. *Cheilanthes ochracea* (Hooker) Hooker, Sp. Fil. 2: 114. 1852. TYPE: Mexico. Michoacán: Morelia, s.d. [1838], *K. T. Hartweg 418* (holotype, K; isotype, L).

Pteris aurantiaca Cavanilles, Descr. Pl. 266. 1801. *Cheilanthes aurantiaca* (Cavanilles) T. Moore, Index Filic. 38. 1857. TYPE: Mexico. [Edo. México]. "Montes de Chalma," s.d., *L. Née s.n.* (holotype, MA).

Pteris lutea Cavanilles, Descr. Pl. 267. 1802. *Cheilanthes lutea* (Cavanilles) T. Moore, Index Filic. 246. 1861. *Aleuritopteris lutea* (Cavanilles) E. Fournier, Mexic. Pl. 1: 121. 1872. TYPE: Mexico. [Edo. México]. "Montes de Chalma," s.d., *L. Née s.n.* (holotype, MA).

The names *Pteris aurantiaca* and *P. lutea* were described on adjacent pages in the same publication, based on specimens collected by the same collector at the same locality during the same expedition. *Pteris lutea* was said to differ mainly in being a somewhat more robust plant. However, these epithets already are occupied in the genus *Notholaena* by *N. aurantiaca* D. C. Eaton (Eaton, 1887) and *N. lutea* (Desvaux) Moore (Moore, 1857). The modern identity of the name *Acrostichum luteum* Desvaux has not been established, as authentic material that might serve as a type for the epithet has not been located at P. However, based on the protologue, *A. luteum* is not conspecific with *Pteris lutea* Cavanilles or *Allosorus ochraceus* Hooker.

During routine determinations of recently collected fern specimens from Nicaragua in support of the junior author's research toward the *Helechos de Nicaragua* Project, we encountered a novel cheilanthoid fern here described as a new species of *Notholaena*.

Notholaena montielae Yatskievych & Arbeláez, sp. nov. TYPE: Nicaragua. Madriz: Cerro Quisuca, along rd. below summit, rocky slopes with low forest, in pocket of soil on shaded rock face, 13°30′42″N, 86°22′09″W, 1090 m, 17 Dec. 2005, *W. D. Stevens & O. M. Montiel J. 26664* (holotype, HULE; isotype, MO). Figure 1.

A *Notholaena aureolina* Yatskievych & Arbeláez differt stipitibus maturis pallide castaneis, paleis rhizomatis angustis, castaneis, ciliatis, et laminis pagina inferiore dense ceraceo-glandulosa, candida; a *N. rosei* Maxon differt stipitibus maturis fractiferis et nudiusculis, et laminis deltatis vel angustim deltatis.

Rhizomes decumbent, compact, 1.5–4 mm diam.; rhizome scales 1.4–3.9 × 0.1–0.7 mm, ± concolorous (lacking lighter marginal bands), castaneous but often with a somewhat lighter central portion at the base, shiny, narrowly lanceolate-subulate, truncate to shallowly and broadly cordate at the base, attenuate to a capillary tip, the margins long-ciliate, the cilia pale and translucent, consisting of 1 to 6 cells. Fronds clustered, 14–35 cm; stipes 7–15 cm, moderately fractiferous (brittle and breaking along well-defined, transverse lines of weakness), especially toward base, terete, with a single vascular trace that is deeply grooved adaxially, light brown (darker at the base, gray with age), with scattered scales in the proximal 1/3 similar to those of the rhizome, otherwise glabrous or occasionally sparsely white-farinose distally; blades 7–20 × 4–7 cm, 2- or 3-pinnate-pinnatifid, deltate to narrowly deltate; rachises terete proximally, flattened or shallowly grooved adaxially distally, somewhat fractiferous with age, light brown, sparsely to moderately white-farinose (more densely so when young), often mostly along the adaxial side; lateral pinnae mostly 6 to 12 pairs, grading into the pinnatifid blade apex, the proximal lateral pinnae asymmetrical basally, the basal basiscopic pinnules somewhat longer than the acroscopic ones; ultimate segments rounded at the tip, hemispherical to narrowly oblong or narrowly oblong-triangular, the smaller ones entire, the larger ones with up to 6 pairs of deep, rounded lobes, densely white-farinose adaxially when young, becoming glabrous or sparsely farinose at maturity, persistently densely white-farinose abaxially (the farina sometimes drying pale yellow in young fronds), lacking scales or nonfarinose trichomes; laminar margins recurved, continuous around the segment tips, but often discontinuous in the sinuses between the larger segment lobes, firm, not strongly modified into scarious pseudoindusia, the recurved area 0.1–0.3 mm wide, ± entire to somewhat erose, the edge with a narrow band of dense farina adaxially. Sporangia submarginal, solitary or to 3 at or near the tips of somewhat broadened (narrowly clavate) vein branches, exposed at maturity. Spores 64 per sporangium, tetrahedral-globose, 46–58 µm diam., the perispore granulate, the granules ± organized into an

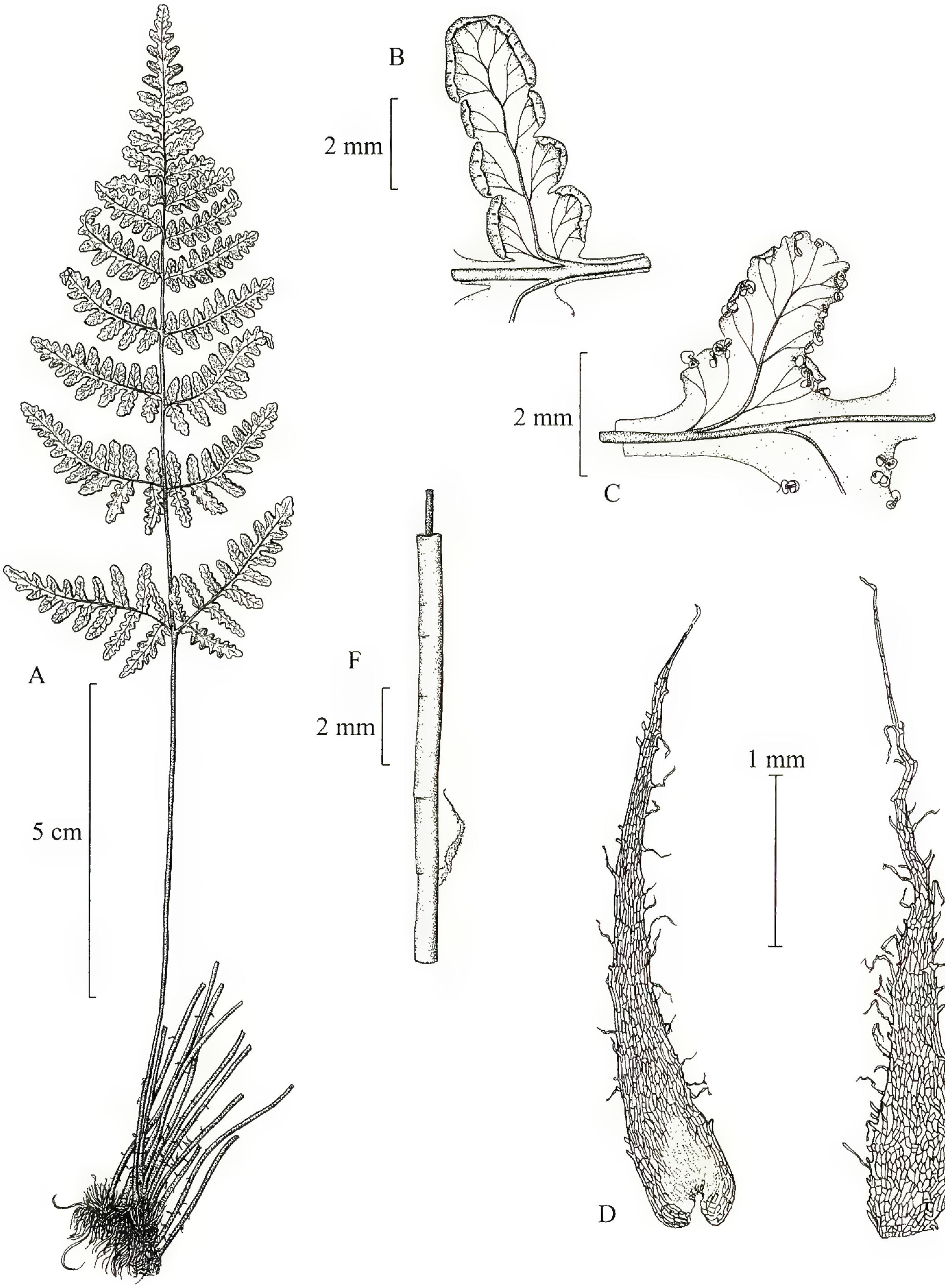

Figure 1. *Notholaena montielae* Yatskievych & Arbeláez. —A. Habit. —B. Sterile segment, abaxial surface, with farina partially removed to expose venation. —C. Fertile segment, abaxial surface, with farina partially removed to expose venation. —D. Rhizome scale. —E. Stipe scale. —F. Stipe segment showing the vascular trace and transverse zones of weakness. A, B, drawn from *Ochoa 58* (MO); C, E, and F, from the isotype, *Stevens & Montiel 26664* (MO); D, from *Navarro 03* (MO).

irregular series of low anastomosing ridges, black at maturity.

Distribution and habitat. Cheilanthoid ferns have generally low diversity in Central America, and it is somewhat surprising to find an undescribed taxon that appears to be endemic to the region. The new species is known thus far from western Nicaragua and adjacent Honduras, where it has been collected infrequently at elevations of 850–1350 m. As with

most cheilanthoid ferns, *Notholaena montielae* is rupestral, with rhizomes occupying the shaded and less drought-prone microhabitat afforded by rock crevices. Limited data suggest that it grows on acidic substrates (basalt at the type locality). The surrounding vegetation varies from relatively dry tropical deciduous woodland to evergreen gallery forest along streams and premontane forest dominated by oaks and/or pines.

Preliminary conservation assessment. There have been no field searches specifically for populations of *Notholaena montielae*. From a conservation assessment perspective, the species may turn out to be Vulnerable (VU) or Near Threatened (NT) in the sense of the IUCN Red List categories (IUCN, 2001), but for the present is best classified Data Deficient (DD).

Eponymy. The name honors our colleague at the Missouri Botanical Garden and well-known authority on the Nicaraguan flora, Olga Martha Montiel J., who is co-collector of the type specimen and who also photographed the new species in nature.

Discussion. In its pattern of laminar dissection and segment shape, as well as its black spores, *Notholaena montielae* resembles *N. aureolina*. It differs from that species in a number of features: lighter stipes; narrower, darker, strongly ciliate (vs. entire) rhizome scales; white (vs. yellow) farinose indument, and relatively narrow and undifferentiated pseudoindusium.

Within *Notholaena*, the only other taxon possessing the combination of light brown stipes, black spores, and white farina is *N. rosei*. In that species, the fronds have a lamina that is narrower relative to its length and is more or less reduced toward the base (narrowly elliptic vs. deltate to narrowly deltate). The lamina of *N. rosei* also tends to have more pinnae pairs (10 to 15 vs. 6 to 12) (Tryon, 1956; Mickel & Smith, 2004). The rhizome scales of *N. rosei* are similar to those of *N. montielae* in their color, texture, and piliform-attenuate tips, but differ in their well-defined, light-colored margins that are less strongly ciliate. The bicolorous nature of the scales is even more pronounced on the stipe scales of *N. rosei*, whereas those of *N. montielae* are concolorous except for the pale cilia. In addition, the stipes of *N. rosei* are shorter (1/4–1/3 vs. 1/3–1/2 the frond length), are not noticeably fractiferous, and are more densely glandular, with the glands along the adaxial surface sometimes producing little or no farina. *Notholaena rosei* was described from Jalisco, Mexico, and subsequently has been collected in Oaxaca (Mickel & Beitel, 1988). It also has been reported from Honduras and Nicaragua (Yatskievych, 1995b; Mickel & Smith, 2004), but all of the Central American reports should now be referred to *N. montielae*.

The affinities of *Notholaena montielae* within the genus require further research. Fragments from the type specimen have been sent to Carl Rothfels, a graduate student at Duke University who is beginning a phylogenetic study of *Notholaena* and its allies.

Paratypes. HONDURAS. **Francisco Morazán:** Parque del Cerro El Picacho, 13 Nov. 1982, *V. L. Ochoa L. 58* (MO, TEFH); Valle de Amarateca, 32 km al N de Tegucigalpa, 4 Sep. 1983, *C. S. Navarro O. 03* (MO, TEFH). NICARAGUA. **Estelí:** Salto de Estanzuela, Río Estanzuela, ca. 6 km S of Estelí, 13°01′N, 86°20′W, 1 Oct. 1979, *Stevens, Grijalva & Araquistain 14409-A* (MO). **Madriz:** Cerro Quisuca, summit and upper slopes, ca. 13°30′N, 86°31′W, 22 Nov. 1979, *Stevens & Grijalva 16035* (MO).

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New taxa of *Pedicularis* (Scrophulariaceae) from the Hengduan Mountains, Southwestern China

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ABSTRACT. One new subspecies and one new variety of *Pedicularis* L. from the Hengduan Mountains region in southwestern China are described. The main diagnostic features of the taxa are compared with closely related taxa, and distributions and morphological photos are provided. The new taxa are: *Pedicularis gyrorhyncha* subsp. *glabrisepala* H. Wang & W. B. Yu and *P. siphonantha* var. *stictochila* H. Wang & W. B. Yu.

Key words: Hengduan Mountains, IUCN Red List, *Pedicularis*, Scrophulariaceae, southwestern China.

Pedicularis L. is one of the largest genera of angiosperms in the northern temperate zone (Li, 1951; Ree, 2005) and belongs to the family Scrophulariaceae as traditionally recognized (Mill, 2001; Yang et al., 1998; Wu et al., 2003; Zhang et al., 2006). There are about 600 to 800 species of this genus distributed primarily in the Arctic and alpine regions of the Northern Hemisphere (Mill, 2001; Wang et al., 2003; Wang & Li, 2005). At least half of the species occur in China, especially in the Hengduan Mountains region of southwestern China, where they represent one of the main centers of species diversity and endemism for this genus (Yang et al., 2003; Wang, 2006).

The flowers of the genus *Pedicularis* show a range of diversity likely unequaled by any other flowering plant genera. The variations of the corolla shape, particularly in the galea (e.g., toothed, toothless, with short or long beak, curved beak, crested), are dramatic among species and infraspecies, as are obvious differences in the corolla tube lengths (from 0.5 mm to 12 cm). Recent phylogenetic analyses of *Pedicularis* indicate extensive parallel evolution in floral traits (Yang et al., 2003; Ree, 2005).

Recently, we conducted extensive field investigations on *Pedicularis* in the Hengduan Mountains region. By careful field observation, we observed interesting and distinct variations in floral color and/or external morphologies, which occur within different populations of the same species. Thus, we propose two new taxa at infraspecific levels within *Pedicularis*.

1. **Pedicularis gyrorhyncha** Franchet ex Maximowicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg 32: 545. 1888. TYPE: China. Yunnan: Heqing Co., Dali to Lijiang, Heqing Guolapo (Koua-la-po), 24 July 1883, *J. M. Delavay 70* (holotype, P not seen, P photo KUN; isotype, US, US image online). Figure 1A, B.

1a. **Pedicularis gyrorhyncha** subsp. **glabrisepala** H. Wang & W. B. Yu, subsp. nov. TYPE: China. Sichuan: Daocheng Co., roadside betw. Mula & Chitu, ca. 3620 m, 18 Aug. 2005, *Wen-bin Yu, Shu-dong Zhang & Ding Wu 86* (holotype, KUN; isotypes, KUN, MO). Figure 1C–E.

A *Pedicular gyrorhyncha* subsp. *gyrorhyncha* Franchet ex Maximowicz, plantis parce pubescentibus, bracteis et calycibus glabris, filamentis posticis 2 glabris differt.

Biennial herbs, 30–100 cm tall, not drying black, sparsely pubescent; rootstock vertical; stems erect, solitary or caespitose, 3 to 5, vertical lines of white pubescence, bearing 3 or 4 slender branches at middle and upper portions. Basal leaves opposite, middle and upper leaves in whorls of 3 or 4; petioles to 30 mm; leaf blade ovate-oblong to lanceolate-oblong, pinnatifid to pinnatipartite; lobes linear-lanceolate to ovate, margin denticulate, slightly reflexed. Inflorescences spicate, interrupted; bracts glabrate, the lower bracts proximal foliaceous, upper ones dilated at the base, linear-lanceolate, longer than flowers, membranous, margin denticulate, slightly reflexed; pedicels short, 1–4 mm. Calyx tube campanulate, ca. 5 mm, membranous, with 10 veins, outer wall glabrous or scarcely pubescent along the thick veins; calyx lobes 5, unequal, callous-dentate and brief pubescence at margin, slightly reflexed, posterior calyx lobe triangular, small and entire, lateral ones large, ca. 5 mm, linear-lanceolate, almost entire; corolla pale yellow, 15–18 mm, corolla tube ca. 1 cm;

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Figure 1. A, B. *Pedicularis gyrorhyncha* subsp. *gyrorhyncha* Franchet ex Maximowicz. —A. Habit (photographed in Shika Mountains of Zhongdian Co., Yunnan Prov., China). —B. Flower, with the pubescent stamens and sepals indicated by arrows (*R. C. Ching 23511* [KUN], collected at the type locality in Heqing Co., Yunnan Prov., China). C–E. *Pedicularis gyrorhyncha* subsp. *glabrisepala* H. Wang & W. B. Yu. —C. Habit. —D. Flower, with the glabrous sepals indicated by an arrow (photographed at the type locality in Daocheng Co., Sichuan Prov., China). —E. Flower, glabrous posterior pair filaments of stamens and calyx marked by arrows (holotype, *Wen-bin Yu, Shu-dong Zhang & Ding Wu 86*, KUN). Scale bars = 1 cm.

corolla beak dark purple, semicircular, ca. 10 mm, 2-lobed at tip; lower lip larger, ca. 10 × 15 mm, ciliate, middle corolla lobe ± rounded, hooded; filaments of stamens attached at the middle of tube, the anterior 2 pubescent, the posterior 2 glabrous; style exserted from beak, spherical. Capsule enclosed by persistent and accrescent calyx, ovate-oblong, apiculate, smooth, ca. 1.5 cm long; immature seed long-oblong, brown.

Distribution. *Pedicularis gyrorhyncha* subsp. *glabrisepala* is endemic to southwestern Sichuan province between 3400 and 4000 m elevation, whereas the subspecies *gyrorhyncha* is endemic to northwestern Yunnan province between 2700 and 4000 m (Fig. 2). The two subspecies are separated by the xerothermic riverside of the Yangtze River and the Daxueshan Mountains.

IUCN Red List category. The new subspecies is not common, occurring in isolated, small populations or as solitary plants at high altitudes. *Pedicularis gyrorhyncha* subsp. *glabrisepala* is probably not threatened because of the high altitude at which it occurs and can be considered Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

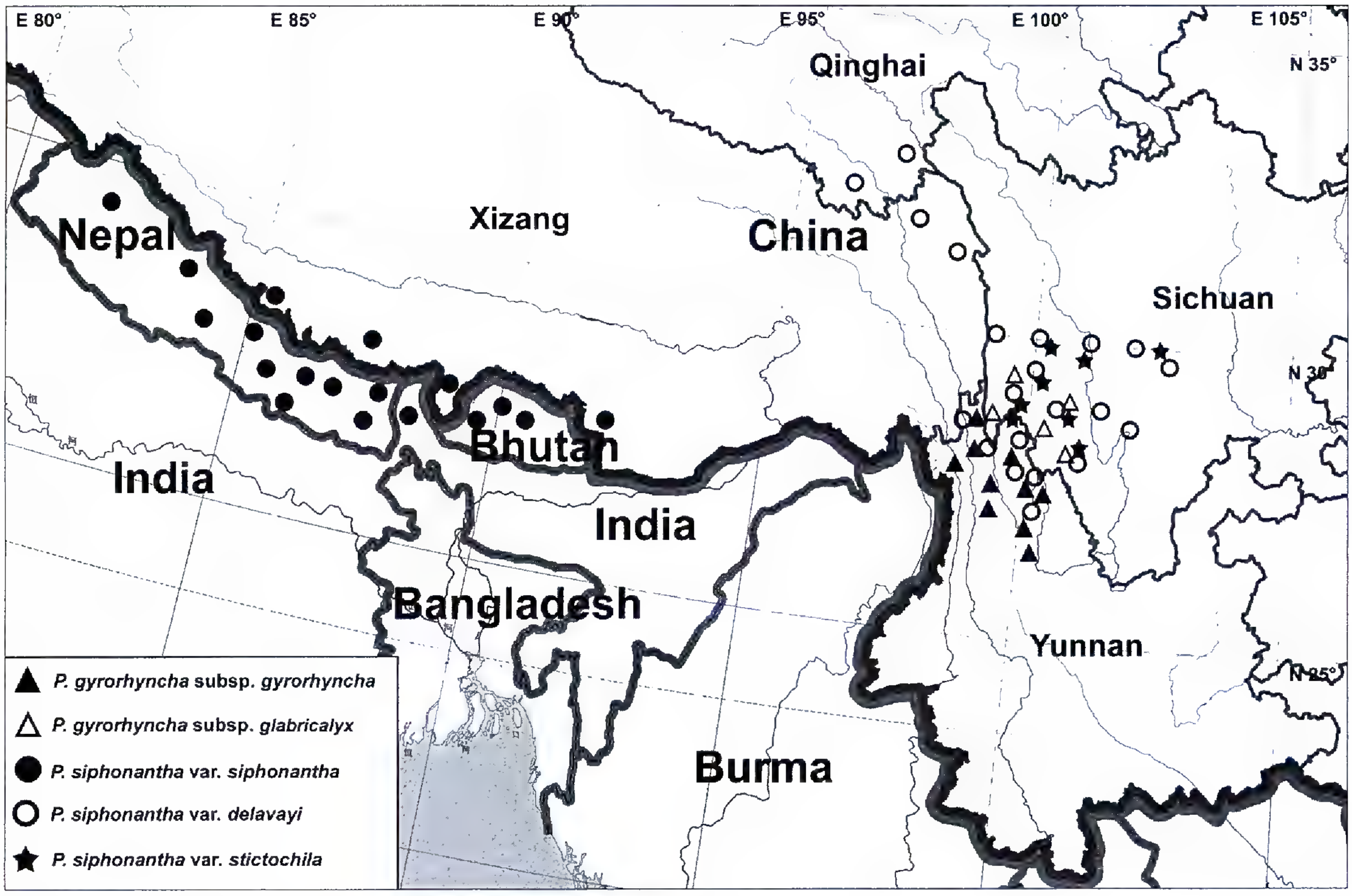

Figure 2. Distribution map of *Pedicularis gyrorhyncha* and *P. siphonantha*.

Phenology. Collected with flowers in August, and with flowers and fruits in September.

Etymology. The epithet "*glabrisepala*" refers to the glabrous sepals of the flowers (Fig. 1D, E), the most distinct characteristic feature in the subspecies.

Relationships. Pedicularis gyrorhyncha subsp. *gyrorhyncha* differs from subspecies *glabrisepala* by the dense pubescence on the whole plant, especially at the stem apex, the bracts, the calyx, and the filaments of the four stamens. In contrast, plants of the new subspecies *glabrisepala* are only sparsely pubescent, with glabrous bracts, a glabrous calyx, and the two posterior filaments of the stamens also glabrous.

Paratypes. CHINA. **Sichuan:** Daocheng Co., ca. 4000 m, 31 Aug. 1981, *Qing-Zang Exped. 5875* (KUN, PE); Derong Co., ca. 3400 m, 4 Aug. 1981, *Qing-Zang Expèd. 3242* (KUN, PE); Muli Co., ca. 3800 m, 7 Sep. 1983, *Qing-Zang Exped. 515* (KUN, PE); Xiangcheng Co., 3800–3900 m, 9 Aug. 1981, *Qing-Zang Exped. 3859* (KUN, PE).

2. Pedicularis siphonantha D. Don, Prodr. Fl. Nepal. 95. 1825. TYPE: Nepal. Gosaingshan, in alpine, *Wallich s.n.* (type, BM not seen). Figure 3A.

2a. Pedicularis siphonantha var. **delavayi** (Franchet ex Maximovicz) Tsoong, Fl. Reipubl. Popularis Sin. 68: 374. 1963. *Pedicularis delavayi* Franchet ex Maximovicz, Bull. Acad. Imp. Sci. Saint-Pétersbourg 32: 531–532. 1888. TYPE: China. Yunnan: Lijiang (Li-kiang monte Sueechan collibus), ca. 4000 m, *J. M. Delavay s.n.* (type, P not seen). Figure 3B, C.

2b. Pedicularis siphonantha var. **stictochila** H. Wang & W. B. Yu, var. nov. TYPE: China. Yunnan: Zhongdian Daxueshan Mtn., Zhongxiang rd., ca. 3750 m, 27 July 2003, *H. Wang, J. Cai, L. Lu & H. B. Chu 03-041* (holotype, KUN; isotype, MO). Figure 3D, E.

A *Pedicularis siphonantha* var. *siphonantha* D. Don, foliorum segmentis magoribus, corollarum tubis longioribus, galea rostro sigmoideo exauriculato instructis, labo maculis 4, atro-purpuratis facile differt.

Perennial herbs, drying slightly black or not; taproots cylindric, ca. 5–7 cm; stems solitary and ± erect, or sometimes caespitose, outer ones procumbent and to 30 cm, striate, pubescent. Leaves basal and cauline, basal ones densely fascicled; petiole of basal leaves 3–5 cm, petiole of cauline leaves 1–3.5 cm, winged, glabrescent or sparsely long-pubescent; leaf blade lanceolate to linear, ca. 1.5–8 × 0.7–1.9 cm, sparsely long-pubescent along midvein and both leaf surfaces, pinnatisect, leaf segments in 7 to 18 pairs, to ca. 6 × 8 mm; lobes somewhat lanceolate to broadly ovate or triangular, pinnatifid or double-dentate, callous-dentate, slightly reflexed. Flowers axillary,

Figure 3. —A. *Pedicularis siphonantha* var. *siphonantha* D. Don (*H. Ohba 8350696* [KUN], collected at Gandaki Zone, Nepal). B, C. *Pedicularis siphonantha* var. *delavayi* (Franchet ex Maximowicz) Tsoong. —B. Specimen collected at the type locality in the Yulong Mountains, Lijiang City, Yunnan Prov., China (*Z. G. Zhao 3038*, KUN). —C. Habit (photographed in Dabasi, Zhongdian Co., Yunnan Prov., China). D, E. *Pedicularis siphonantha* var. *stictochila* H. Wang & W. B. Yu. —D. Holotype (*H. Wang, J. Cai, L. Lu & H. B. Chu 03-041*, KUN). —E. Habit (photographed at the type locality in Zhongdian Daxueshan, Zhongdian Co., Yunnan Prov., China). Scale bars = 2 cm.

dense, sometimes interrupted at basal position; bracts leaf-like, membranous; calyx tubular, ca. 0.7–1.1 cm excluding lobes, sparsely long-pubescent, 1/3 cleft anteriorly. Calyx lobes 3, leaf-like, posterior lobe smallest; corolla purple or rose-red, white at throat; corolla tube erect, ca. 8–10 cm, slender, tube wall finely pubescent; galea strongly twisted at apex, without auriculate, with numerous small dark purple spots; corolla beak slender, conspicuously S-shaped, bent upward, to 1.1 cm; lower lip ciliate, ca. 0.8 × 1.5 cm, with 4 deep purple spots, 2 on middle lobe, 1 on each lateral lobe; middle lobe slightly smaller, emarginate, 2-lobed; filaments attached near tube throat, anterior pair pubescent, posterior pair sparsely pubescent or glabrous. Capsule ovate-oblong; immature seed linear-ovate, brown.

Distribution. *Pedicularis siphonantha* var. *siphonantha* is only distributed in the Himalayas from western Nepal to Bhutan and southeastern Xizang Autonomous Region. The other variety *delavayi* is distributed in southeastern Qinghai, eastern Xizang, western Sichuan, and southwestern Yunnan of China. The distribution of variety *stictochila* overlaps with variety *delavayi* in southwestern Sichuan province, but the two varieties were not observed to occur in the same population (Fig. 2).

IUCN Red List category. *Pedicularis siphonantha* var. *stictochila* is not common, and it is restricted to alpine meadows. Its habitats are not likely to be threatened by human activities, but its continued existence may well be threatened by climate change. This variety can be considered Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Collected with flowers in July, and with flowers and fruits in August.

Etymology. The specific epithet "*stictochila*" refers to the variety's lower lip with four dark purple spots (Fig. 3E). This morphological character is distinctive from other varieties of *P. siphonantha.* However, because of the close relationship and sympatry with *P. siphonantha* var. *delavayi*, it is treated at the varietal level here.

Relationships. *Pedicularis siphonantha* var. *siphonantha* differs from other varieties in having a conspicuous auriculate protrusion at the base of the floral galea. *Pedicularis siphonantha* var. *delavayi* and the typical variety bear leaves ca. 1–6 × 0.7–1.6 cm, the leaf segments in 6 to 15 pairs, ca. 1.5–4 × 6 mm, the corolla tubes less than 7 cm, the lower corolla lip lacks the dark purple maculation, and the corolla beak is semicircular or slightly S-shaped. In contrast, *P. siphonantha* var. *stictochila* has leaves ca. 1.5–8 × 0.7–1.9 cm, the leaf segments are in 7 to 18 pairs, and to ca. 6 × 8 mm, the corolla tube is longer than 8 cm, the lower lips of the corolla are remarkable for their four dark purple spots, the floral galea lacks an auriculate protrusion, and the beak is conspicuously S-shaped.

Paratypes. CHINA. **Sichuan:** Xiangcheng Co., alpine meadows, ca. 3600–3900 m, 17 Aug. 2005, *Wen-bin Yu, Shu-dong Zhang & Ding Wu 74* (KUN); meadow slope, ca. 4200 m, 10 Aug. 1973, *Xiang 3038* (KUN, PE). **Yunnan:** Zhongdian Co., Daxueshan, under forest or meadow, ca. 3800 m, 28 Aug. 2002, *Wen-li Li & Xue Yang 091* (KUN, MO); alpine meadows, ca. 4100–4200 m, 16 Aug. 2005, *Wen-bin Yu, Shu-dong Zhang & Ding Wu 44* (KUN).

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El Incienso de Bolivia: Una Especie Nueva de *Clusia* (Clusiaceae) de los Bosques Montanos del Norte de La Paz, Bolivia

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RESUMEN. Se describe e ilustra un árbol conocido en Bolivia como "incienso", *Clusia pachamamae* Zenteno-Ruíz & A. Fuentes (Clusiaceae), una especie nueva de los bosques montanos de Yungas del noroeste de Bolivia. Especie que se diferencia claramente de otras de la sección *Anandrogyne* Planchon & Triana por tener inflorescencias en espiga, corto-pedunculadas con 6 a 16 flores. Se distingue de varias especies morfológicamente afines, también con flores sésiles, de la siguiente manera: de *C. tarmensis* Engler por tener los frutos 5-, rara vez 6- (vs. siempre 6-)loculares y hojas con pecíolo alado 1.5–2.6 × 0.6–1.8 cm (vs. 0.4–0.8 × 0.2–0.3 cm); de *C. peruviana* Szyszylowicz por las hojas obovadas a rara vez elípticas mayores a 9 cm de largo (vs. elípticas y menores a 9 cm) y la inflorescencia masculina con 6 a 16 (vs. 3 a 5) flores; de *C. cajamarcensis* Engler por tener flores con 5 (vs. 6) pétalos y el ovario 5-, rara vez 6- (vs. siempre 6-) locular. Esta especie exuda de su corteza y ramas una resina amarilla que es recolectada y comercializada por los pobladores locales del noroeste de Bolivia y usada tradicionalmente como incienso en rituales andinos y católicos.

ABSTRACT. A *Clusia* L. incense tree, *Clusia pachamamae* Zenteno-Ruíz & A. Fuentes (Clusiaceae), is described and illustrated. This new species from the montane Yungas forests of northwestern Bolivia differs clearly from other species of section *Anandrogyne* Planchon & Triana in having spicate short-pedunculate inflorescences with six to 16 sessile and decussate flowers. The species differs from various others to which it is morphologically close (and which also have sessile flowers) in the following ways: from *C. tarmensis* Engler by having 5- or rarely 6- (vs. always 6-)locular fruits and leaves with winged petioles 1.5–2.6 × 0.6–1.8 cm (vs. 0.4–0.8 × 0.2–0.3 cm); from *C. peruviana* Szyszylowicz by having obovate to rarely elliptic leaves more than 9 cm long (vs. elliptic and less than 9 cm), and a male inflorescence with six to 16 (vs. three to five) flowers; from *C. cajamarcensis* Engler by having flowers with five (vs. six) petals and a 5- or rarely 6- (vs. always 6-)locular ovary. This species exudes from its bark and branches a yellow resin that is collected and marketed by local villagers northwest of Bolivia where it is used traditionally for incense in Andean and Catholic rituals.

Key words: Bolivia, *Clusia*, Clusiaceae, incense, IUCN Red List, section *Anandrogyne*, Yungas montane forest.

El árbol conocido como "incienso" en Bolivia es una especie de *Clusia* L. (Clusiaceae) que crece en los bosques montanos de Yungas en el norte del departamento de La Paz. Este árbol produce una resina la cual probablemente fue conocida desde antes de la colonia y reportada desde 1687 por las misiones franciscanas de Apolobamba o frontera con Caupolican en el departamento de La Paz (Landaeta, 1903). En la actualidad la resina es ampliamente utilizada como incienso tanto en rituales tradicionales andinos como católicos. Existe además una especie del género *Protium* Burmeister f. (Burseraceae), en los bosques montanos, cuya resina es también empleada como incienso, pero ésta es conocida en el país con el nombre común de "copal". La demanda comercial por la resina del "incienso" crece en mercados nacionales e internacionales, constituyéndose en un importante recurso alternativo del bosque para las poblaciones locales. La extracción se ha incrementado particularmente en las áreas protegidas de Madidi, Apolobamba y Cotapata (Zenteno-Ruíz, 2007). Curiosamente esta

especie a pesar de ser ampliamente conocida y usada en Bolivia ha permanecido prácticamente desapercibida por la comunidad científica. Nuestros estudios indican que hasta la fecha no cuenta con un nombre científico correctamente aplicado (ver más adelante), omisión que probablemente se deba a que el árbol de incienso se suele encontrar en áreas poco accesibles generalmente a días de caminata de cualquier poblado (Zenteno-Ruíz, 2007). Por otro lado en la región andina, el género *Clusia* y sobre todo la sección *Anandrogyne* Planchon & Triana es muy diverso, complejo y recientemente se está investigando (Gustafsson et al., 2007).

La presente contribución define la entidad taxonómica de este importante recurso del bosque montano, formalizando un nombre científico para la especie.

Clusia pachamamae Zenteno-Ruíz & A. Fuentes, sp. nov. TIPO: Bolivia. La Paz: Prov. Franz Tamayo, Parque Nac. Madidi, inciensal Linter, 2.5 km NW del camp. Fuertecillo (camino entre Queara y Mojos), 14°35′37.8″S, 68°57′22.7″W, 2170 m, 23 abr. 2007 [♀ fl], *A. Fuentes, A. Fernández, M. Chambi & F. Zenteno 11360* (holotipo, LPB; isotipos, BOLV, LPB, MO, NY, USZ). Figuras 1, 2.

Haec species *Clusiae tarmensis* Engler similis, sed ab ea foliorum petiolus alatus 1.5–2.6 × 0.6–1.8 cm (vs. 0.4–0.8 × 0.2–0.3 cm), sepalis 4 (vs. 6), petalis 5 (vs. 6 ad 8) atque ovario 5- vel 6- (vs. 6-)loculari differt; etiam a *C. peruviana* Szyszylowicz foliis plerumque obovatis, 8.4–20 cm longis (vs. ellipticis et 6–9 cm longis) atque inflorescentia mascula 6 ad 16 (vs. 3 ad 5) flora, a *C. cajamarcensi* Engler petalis 5 (vs. 6) atque ovario 5- vel 6- (vs. 6-)loculari differt.

Árbol dioico 4–8(–12) m de alto; tronco 10–15(25) cm diám. a la altura del pecho, generalmente con raíces adventicias, la corteza externa a veces cubierta de líquenes crustáceos blanco-grisáceos, la corteza interna blanquecina, que oxida a rojizo; savia pegajosa amarillo-clara que al cristalizar se torna amarilla; ramas foliosas cilíndricas a subcuadrangulares, 0.5–1.4 cm diám., gris claras a pardo- amarillentas, glabras, a veces fistulosas, la peridermis estriada transversalmente, en seco longitudinalmente corrugadas. *Hojas* simples, decusadas, el pecíolo alado 1.5–2.6 × 0.6–1.8 cm; lámina 9.5–20(–25.5) × 5–10(–13.5) cm, obovada, rara vez elíptica, coriácea, subcarnosa, glabra; base decurrente subamplexicaule; ápice redondeado, rara vez obtuso; margen entero, levemente revoluto; haz verde oscuro; envés blanco-verdoso a blanco-amarillento, a veces magenta en hojas jóvenes; nervio principal redondo en sección transversal, en fresco suavemente prominente en el haz y muy prominente en el envés, terminando antes del ápice de la hoja; nervios secundarios (30)35 a 45(55) pares, con un ángulo de ca. 70°–75°, poco prominentes en el haz y prominentes en el envés. *Inflorescencia* terminal, 1 o rara vez 2 espigas paucifloras; brácteas florales triangulares, 0.3–1 × 0.3–0.5 cm, coriáceas subtendiendo una sola flor; inflorescencia masculina 3.3–7.5 cm de largo, el raquis 2–6 × 0.2–0.5 cm, tetragonal, el pedúnculo 0.5–1 × 0.4–0.6 cm, tetragonal, flores 6 a 16; inflorescencia femenina 2–4.5 cm, el raquis 1.6–2.4 × 0.4–0.7 cm, tetragonal, el pedúnculo 0.4–0.7 × 0.4–0.7 cm, tetragonal, flores 7 a 11. *Flores* unisexuales; sépalos 4, ca. 1 × 1.1 cm, anchamente ovados, cóncavos, coriáceos, margen entero, escarioso, el ápice redondeado; pétalos 5, ca. 1–1.7 × 0.6–1 cm, blanco-amarillentos, obovados a oblongos, algo cóncavos, subcarnosos, el ápice redondeado; flores masculinas con 50 a 75 estambres, los filamentos cortos ca. 0.5 × 2 mm, blancos a pardo-claros a la madurez, las anteras ca. 3.5 × 0.7 mm, lineares, rojizas; flores femeninas con 5 estilos, rara vez 6, ca. 1 × 0.8 mm, los estigmas capitados y papilosos, ca. 1.6 × 2 mm, blanco-amarillentos. *Infrutescencias* hasta 6 cm, congestas a la madurez; *fruto* cápsula septicida, 2.5–4 cm diám., esférica, carnosa, verde-amarillenta a verde clara con matices rojizos a la madurez; estilos 5, rara vez 6, 3–5 mm, persistentes, los estigmas capitados, papilosos, los lóculos 5, rara vez 6, la columnela 1.3–2 × 0.8–1.5 mm, leñosa, con 5 o rara vez 6 alas; semillas ca. 8 por lóculo, 5–6 × 2–2.5 mm, verde-parduzcas, alargado-reniformes; arilo carnoso, naranja intenso.

Discusión. *Clusia pachamamae* es distintiva por presentar inflorescencias en espiga, característica que comparte con *C. tarmensis* Engler, una especie del Perú, de la cual se diferencia por tener las hojas con peciolo alado (1.5–2.6 × 0.6–1.8 cm vs. 0.4–0.8 × 0.2–0.3 cm), flores con 4 (vs. 6) sépalos, 5 (vs. 6 a 8) pétalos y por los frutos 5- a rara vez 6- (vs. siempre 6-)loculares. La especie nueva difiere de *C. peruviana* Szyszylowicz y *C. cajamarcensis* Engler con inflorescencias paniculadas, espiciformes y paucifloras, también con flores sésiles, por sus hojas más grandes (8.4–20 cm vs. 6–9 cm). Además *C. pachamamae* difiere de *C. peruviana* por su inflorescencia masculina con más flores (6 a 16 vs. 3 a 5) y por sus hojas obovadas a rara vez elípticas (vs. elípticas). La especie nueva difiere de *C. cajamarcensis* por sus flores con menos pétalos (5 vs. 6), y ovarios con memos lóculos (5 a rara vez 6 vs. 6).

Diversos autores han aplicado varios nombres científicos a este árbol de incienso en Bolivia. Girault (1987) identificó la especie como *Clusia lineata* (Bentham) Planchon & Triana, Cárdenas (1989) la identificó como *C. ramosa* Rusby, y Correa y Bernal

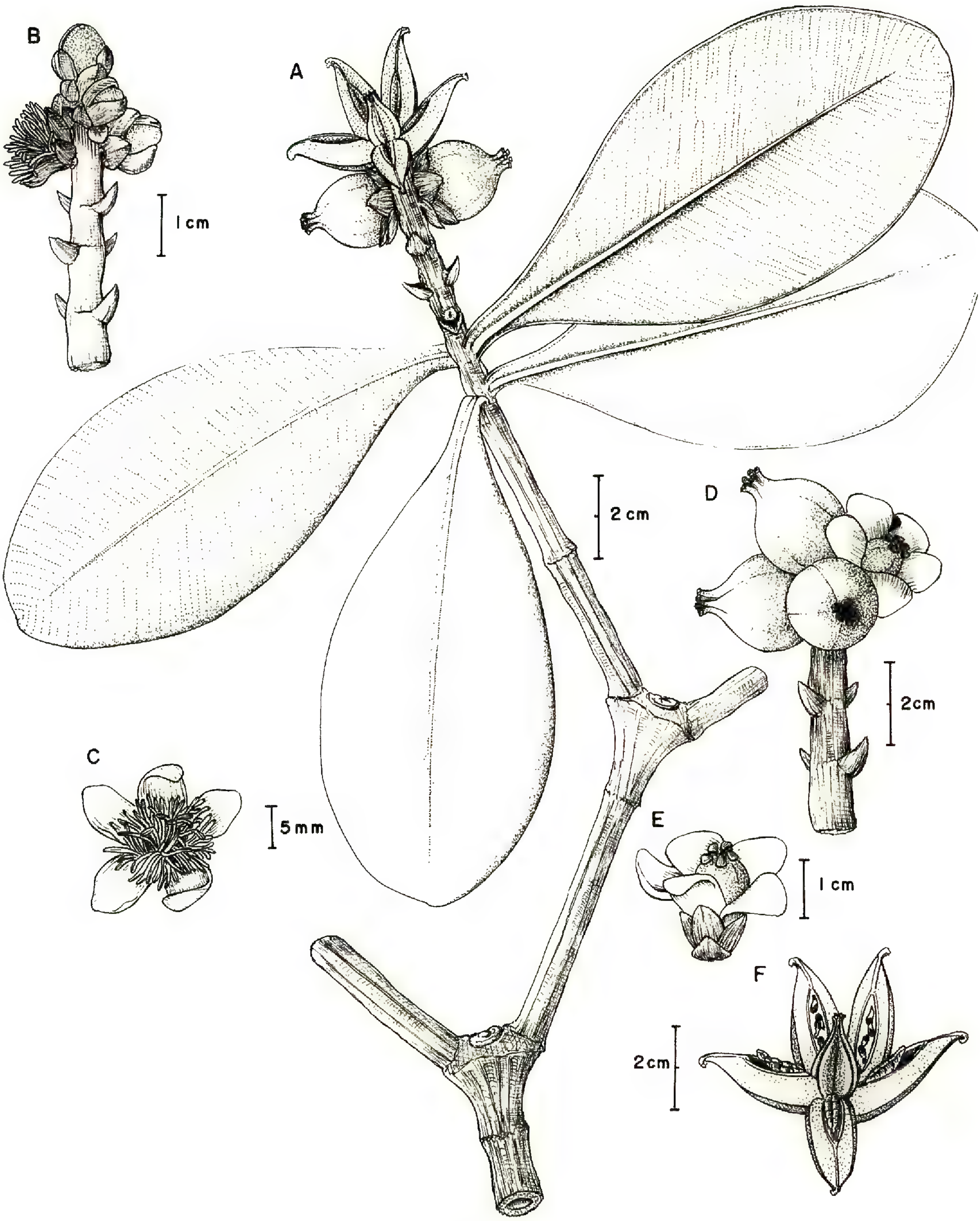

Figura 1. *Clusia pachamamae* Zenteno-Ruíz & A. Fuentes. —A. Rama con frutos. —B. Inflorescencia masculina. —C. Flor masculina con numerosos estambres. —D. Inflorescencia femenina. —E. Flor femenina. —F. Fruto maduro abierto con semillas. A, D y F dibujados de *F. Zenteno et al. 6536* (LPB, MO, NY); B y C de *Zenteno et al. 6841* (LPB, MO, NY, USZ); E de *A. Fuentes et al. 11360* (holotipo, LPB, MO, NY, USZ).

(1993) como *C. multiflora* Kunth. Todas estas especies presentan inflorescencias paniculadas y difieren de la presente en muchos más detalles. Hasta la fecha no se ha reportado que la resina de otra especie de *Clusia* aparte de *C. pachamamae* se emplee como incienso en Bolivia.

Clusia thurifera Planchon & Triana el árbol del incienso en Perú (Planchon & Triana, 1860), se

Figura 2. Fotos de *Clusia pachamamae* Zenteno-Ruíz & A. Fuentes. —A. Inflorescencia masculina. —B. Fruto maduro abierto mostrando las semillas cubiertas de arilo. —C. Flor femenina. A, A. Fuentes, de *Zenteno et al. 6841* (LPB); B, Cortesía de Wildlife Conservation Society Bolivia; C, A. Fernández, del holotipo *Fuentes et al. 11360* (LPB).

diferencia de *C. pachamamae* por tener inflorescencias paniculadas con tres flores. Otras especies de *Clusia* empleadas como incienso en Sudamérica incluyen a *C. mocoensis* Cuatrecasas en Colombia (Gupta, 2006) y *C. pallida* Engler en Perú (Proyecto Tambopata-Inambari, sin año), las cuales también tienen inflorescencias paniculadas, además de pertenecer a otra sección del género, sect. *Androstylium* Miquel (Engler, 1925).

Distribución y hábitat. *Clusia pachamamae* hasta el momento se conoce solamente en los bosques montanos entre 1700–2400(–2500) m, en áreas con elevada precipitación pluvial en el norte del departamento de La Paz, Bolivia, generalmente en situaciones particulares como cabeceras de cerros y laderas expuestas a los vientos alisios húmedos. Suele estar asociada a especies de *Podocarpus* L'Héritier ex Persoon (Podocarpaceae), *Weinmannia* L. (Cunoniaceae), *Clusia* (Clusiaceae), *Myrsine* L. (Myrsinaceae), *Psychotria* L. (Rubiaceae), *Persea* Miller (Lauraceae), *Ternstroemia* Mutis ex L. f. (Theaceae), *Freziera* Willdenow (Theaceae) y *Symplocos* Jacquin (Symplocaceae), a veces con abundancia de gramíneas del género *Chusquea* Kunth (Poaceae) y en ocasiones *Neurolepis* Meisner (Poaceae). En otros casos el incienso se encuentra acompañado de especies como *Dictyocaryum lamarckianum* (Martius) H. Wendland, *Euterpe precatoria* var. *longevaginata* (Martius) A. J. Henderson (Arecaceae) y *Protium montanum* Swart (Burseraceae) (Zenteno-Ruíz, 2007).

Conservación y uso. La progresiva valoración económica de la resina de *Clusia pachamamae* y los

bajos precios de la agricultura, está repercutiendo en una desordenada y mala recolección del incienso. La frecuencia de recolección esta aumentando de cada 6–12 a ca. 3 meses, y los excesivos cortes en el tronco y las ramas para obtener la resina están ocasionando daños físicos y progresiva mortandad en las poblaciones (Zenteno-Ruíz, 2007). Si bien los rodales de incienso se encuentran en bosques en buen estado de conservacion y en áreas alejadas de los poblados principales (p. ej., áreas protegidas de Apolobamba, Cotapata y Madidi), los mismos no están libres de ser cosechados, por esta razón su protección a mediano o largo plazo no está asegurada. Por las anteriores causas consideramos a *C. pachamamae* preliminarmente como VU (Vulnerable) segun los criterios IUCN (2001): [VU A3d], donde se estima una reducción de sus poblaciones mayor del 30%, debido a una sobreexplotacion-expansion del área de cosecha y un mercado potencial.

Fenología. *Clusia pachamamae* se encuentra con flores entre febrero y julio, y con frutos entre septiembre y enero (Zenteno-Ruíz, 2007).

Etimología y nombre común. La especie es conocida localmente como "incienso", pero también se la conoce en lenguas nativas de la región como "miskki asnakk" en Quechua, "tarapu" en Aymara y "churiri" en Kallawaya (Girault, 1987). Esta especie promisoria tiene un uso arraigado y es frecuente en festividades y actos religiosos andinos, especialmente en las ceremonias y rituales relacionados a la Pachamama, deidad andina que representa a la madre tierra (por ello, el epíteto que le dedicamos). También es utilizado en sahumerios y en la challa, acto para agradecer cualquier buen material o espiritual que se ha obtenido. Girault (1987) reporta su uso en medicina tradicional como purgante, desinfectante y cicatrizante.

Paratipos. BOLIVIA. **Dpto. La Paz:** Prov. Bautista Saavedra, Área Natural de Manejo Integrado (ANMI) Apolobamba, Ininlaya, 27 abr. 2005 (fl), *A. Fuentes, R. Cuevas, E. Cuevas & H. Pariamo 7386* (LPB, MO); ANMI Apolobamba, Yurilaya, subiendo a cabecera Majata, 12 sep. 2001 (fr), *F. Zenteno 120A* (LPB); Parque Nac. (PN) Madidi, Camp. San Isidro, 25 ago. 2002 (st), *F. Zenteno & R. Cuevas 1424* (LPB); San Juanito, Laji, 18 nov. 2002 (fr), *F. Zenteno & R. Cuevas 1527* (LPB); Cabecera Iwilini-Laji, 26 sep. 2002 (fr), *F. Zenteno & R. Cuevas 1558* (LPB); Prov. Franz Tamayo, PN Madidi, inciensal Linter, 2.8 km NW del camp. Fuertecillo, 23 abr. 2007 (fl), *F. Zenteno, A. Fuentes, A. Fernández & M. Chambi 6841* (LPB, MO, NY, USZ); PN Madidi, Sauce, Virgen del Rosario, 27 may. 2002 (fl), *C. Veicht 2* (LPB); PN Madidi, Sumpulo, 8 jul. 2005 (fr), *A. Fuentes, E. Cuevas, R. Cuevas & V. Cuili 9555* (LPB, MO); PN Madidi, Tentación Chico, 11 jun. 2002 (st), *F. Zenteno 1492A* (LPB); Prov. Sud Yungas, Comun. San Agustin, entre Chulumani y Asunta, dic. 1996 (fr), *S. Aruquipa 100* (LPB); Prov. Nor Yungas, bosque arriba del final del camino a Chairo, 21 jun. 1997 (st), *S. Beck 2331* (LPB, MO); ANMI Cotapata, Santa Catalina, ca. 200 m al E de antiguo campamento mina Ensueño, 7 ene. 2007 (fr), *F. Zenteno, A. Fuentes, T. Miranda, E. Llanos, S. Condori & V. Pérez 6536* (LPB, MO, NY).

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A New Species of *Cardamine* (Brassicaceae) from Hunan, China

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Abstract. The new species *Cardamine hupingshanensis* K. M. Liu, L. B. Chen, H. F. Bai & L. H. Liu is described and illustrated from Hupingshan National Nature Reserve in northwestern Hunan, China. The new species is distinctive and assigned to section *Cardamine* L. according to its rhizomes, petioles sometimes with lateral leaflets, flowers, and coiled valves during dehiscence. The habitat is aquatic or subaquatic. Based on the leaf shape, it is similar to *C. circaeoides* Hooker f. & Thomson but is distinguished by its stout rhizomes and broadly obovate petals. The chromosome number is $2n = 24$.

Key words: Brassicaceae, *Cardamine*, China, Hunan, IUCN Red List.

The genus *Cardamine* L. is one of the largest genera of the family Brassicaceae, comprising at least 200 species distributed worldwide (Warwick et al., 2006). It is represented in China by about 48 species, of which nearly 30 are endemic. There are about 10 species of *Cardamine* in Hunan province (Al-Shehbaz, 2000; Huang et al., 2004). The new species, called "Shanbaicai" or "Shuiyoucai" by the native people, was found during our exploration of the wild vegetable resources in Hupingshan National Natural Reserve. It has been cultivated at Huzhou University since 2003.

Cardamine hupingshanensis K. M. Liu, L. B. Chen, H. F. Bai & L. H. Liu, sp. nov. TYPE: China. Hunan: Hupingshan Natl. Natural Res., Dadongping cavern, 30°09′N, 110°59′E, 7 July 2006, *H. F. Bai 06003* (holotype, HU; isotype, HNNU). Figure 1.

Species *Cardaminae circaeoidi* Hooker f. & Thomson affinis, sed rhizomatibus validis, foliis suborbicularibus vel reniformibus, 4–13 × 5–14 cm, sepalis ovatis, 5–6 × 3–4 mm, petalis late ovatis, 8–10 × 7–9 mm, fructibus linearibus, 20–30 × 1.5–2 mm, stylis 5–6 mm longis, seminibus oblongis, 1.2–1.8 × 0.9–1.3 mm differt.

Herbs perennial, 30–100 cm tall, aquatic or subaquatic, glabrous throughout; rhizomes stout, often with bulbils; stems erect or flexuous, columned, simple or branched above and/or basally. Basal leaves rosulate before bolting, simple, petiolate; leaf blade 4–13 × 5–14 cm, reniform or suborbicular, palmately veined, margin crenate or repand-crenate; petiole 3–12 cm, sometimes with reduced/few lateral leaflets, 2 to 4 pairs; cauline leaves resemble basal, margin serrate or crenate; basal leaves withered by flowering. Sepals ovate, 5–6 × 3–4 mm, margin often membranous; petals white, veined, broadly obovate, 8–10 × 7–9 mm; attenuate at base to a claw 1.5–2 mm; stamens 6; median filament pairs 5–6 mm, lateral filaments 3–4 mm; anther ca. 2 mm; pistil glabrous; style terete, 5–6 mm; stigma conical. Fruiting pedicels 1–2 cm, slender, straight or secund; fruit as dehiscent siliques, linear, 20–30 × 1.5–2 mm; seeds brown, yellow, or green, broadly oblong, 1.2–1.8 × 0.9–1.3 mm, wingless, 1000-seed weight 0.58–0.62 g. Chromosome number $2n = 24$.

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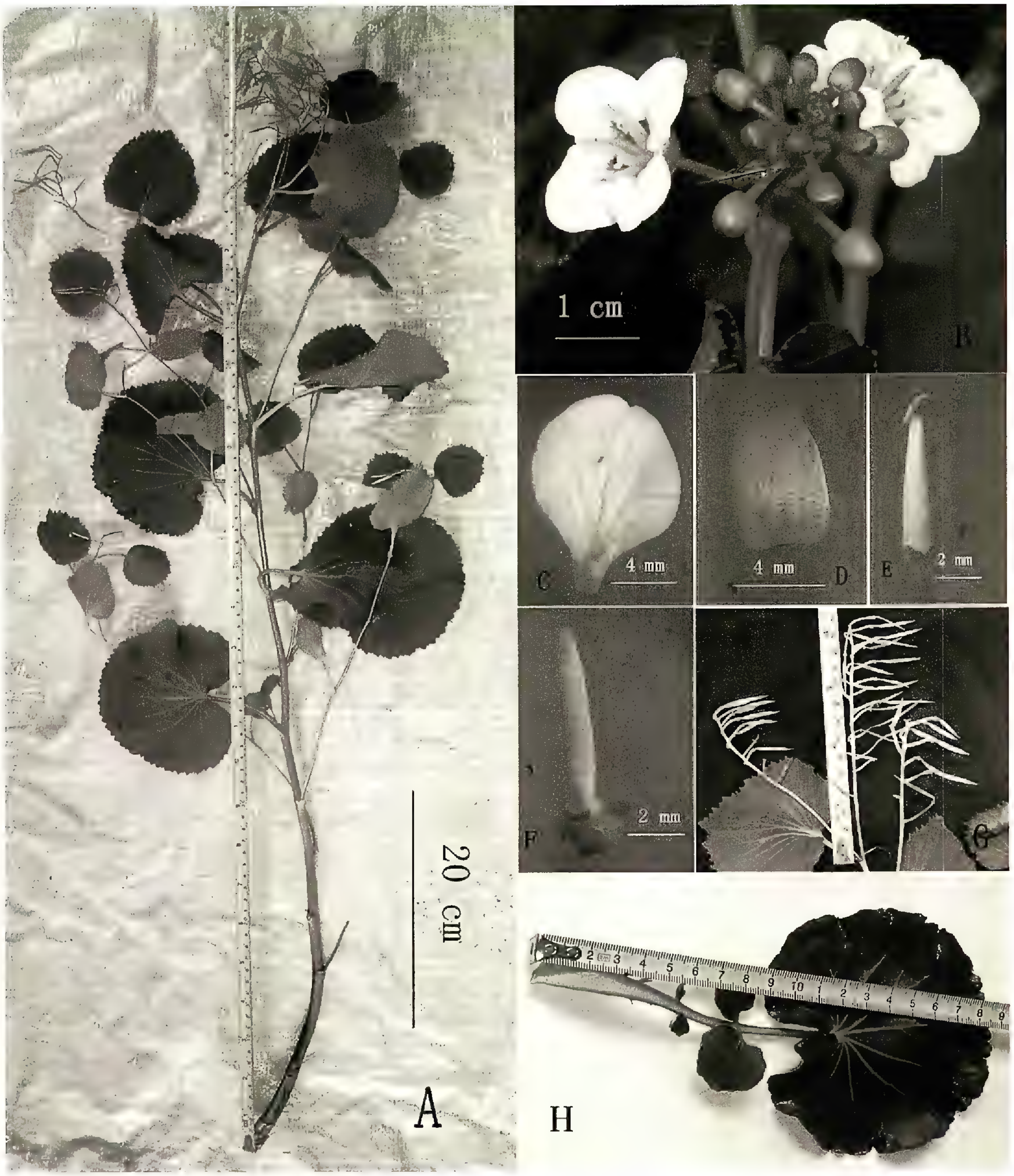

Figure 1. *Cardamine hupingshanensis* K. M. Liu, L. B. Chen, H. F. Bai & L. H. Liu. —A. Habit. —B. Inflorescence and flower. —C. Petal. —D. Sepal. —E. Stamens. —F. Pistil. —G. Siliquae. —H. Basal rosette leaf. Photographs from the holotype *H. F. Bai 06003* (HU).

The chromosome number of *Cardamine hupingshanensis* is $2n = 24$, which has never been reported before within *Cardamine* except *C. pratensis* L. ($2n =$ 16, 24, 28–34, 38–44, 48, 56, 96), and its karyotype is characterized by eight metacentric, 12 submetacentric, and four subteliocentric chromatids (Stebbins, 1971; Lihová & Marhold, 2006; Warwick et al., 2006).

Distribution. *Cardamine hupingshanensis* is found in China, restricted to Hunan province, from 800–1400 m. The distribution of this new species indicates that it is rare. Only three populations containing a total of 2000 to 2500 individuals were found in Hupingshan National Natural Reserve. The type population consists of only about 800 individuals in a small stream (sometimes with plants submerged at

bases) under partial to full shade of trees near the Dadongping cavern.

IUCN Red List category. Because the areas of habitat have declined gradually and the species is endemic to stream habitats, *Cardamine hupingshanensis* should be considered Endangered (EN) according to IUCN Red List criteria (IUCN, 2001). Strict conservation measures to safeguard the known populations are urgently needed. *Cardamine hupingshanensis* has three allopatric populations distributed among the Dadongping cavern, Hangrangping village, and Huping village in Hunan province.

Phenology. Observed as flowering from May to June; fruiting from June to July.

Relationships. Cardamine hupingshanensis is similar to *C. circaeoides*, which differs in its smaller spatulate petals (4–8 × 1.5–4 mm) and ovate or oblong sepals (2–3.5 × 0.8–1.5 mm), as well as by its slender rhizomes and stem. The leaf blade of *C. circaeoides* is always cordate or ovate, and longer than wide, while *C. hupingshanensis* always has a reniform or suborbicular leaf blade.

Paratypes. CHINA. **Hunan:** Hupingshan Natl. Natural Res., Hangrangping, 7 July 2007, *H. F. Bai 200702* (HU); Huping village, 6 July 2007, *H. F. Bai 200705* (HU).

KEY TO THE SPECIES OF *CARDAMINE* IN HUNAN, CHINA

1a. Cauline leaves simple, rarely obscurely 2- or 3-lobed; cauline leaves resemble basal leaves.
  2a. Petals broadly obovate, 8–10 × 7–9 mm . . . . . *C. hupingshanensis*
  2b. Petals ovate or oblong, 4–8 × 1.5–4 mm . . . . . *C. circaeoides*
1b. Cauline leaves trifoliolate, pinnatisect or pinnately compound; basal leaves variously shaped.
  3a. Petals purple, lavender, or pink.
    4a. Cauline leaves sessile. . . . . *C. griffithii* Hooker f. & Thomson
    4b. Cauline leaves petiolate.
      5a. Lateral leaflets 2 to 11 pairs, similar to but slightly smaller than terminal leaflet . . . . . *C. macrophylla* Schur
      5b. Lateral leaflets 1 or 2 pairs, subequal or terminal larger . . . . . *C. fragariifolia* O. E. Schulz
  3b. Petals white.
    6a. Plants with long stolons.
      7a. Stolons bearing simple leaves; cauline leaves sessile; seeds broadly winged . . . . . *C. lyrata* Bunge
      7b. Cauline leaves petiolate; seeds wingless. . . . . *C. calcicola* W. W. Smith
    6b. Plants without stolons.
      8a. Herbs annual, cauline leaves shortly petiolate; lateral lobes 2 to 10 on each side of midvein *C. hirsuta* L.
      8b. Herbs biennial or rarely annual.
        9a. Petals oblanceolate; cauline leaves with petiole auriculate, auricles lanceolate or linear . . . . . *C. impatiens* L.
        9b. Petals obovate, spatulate or spatulate to oblong-oblanceolate.
          10a. Rhizomes slender; stems flexuous . . . . . *C. leucantha* (Tausch) O. E. Schulz
          10b. Rhizomes stout or thick; stems erect.
            11a. Basal leaves trifoliolate. . . . . *C. anhuiensis* D. C. Zhang & J. Z. Shao
            11b. Basal leaves pinnate. . . . . *C. hygrophila* T. Y. Cheo & R. C. Fang

Acknowledgments. The authors are grateful to the anonymous reviewer for critical comments on the manuscript. We also acknowledge Hai-Yang Zhang for his enthusiastic help and encouragement.

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Micranthes hitchcockiana (Saxifragaceae), a New Combination for North America

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Abstract. Following recent phylogenetic work segregating *Micranthes* Haworth from *Saxifraga* L. (Saxifragaceae) and to complete the transfer of names from *Saxifraga* to *Micranthes* in North America, we are proposing the new combination *M. hitchcockiana* (Elvander) Brouillet & Gornall.

Résumé. Les analyses phylogénétiques récentes ont distingué *Micranthes* Haworth de *Saxifraga* L. (Saxifragaceae). Afin de compléter le transfert nomenclatural des espèces de *Saxifraga* à *Micranthes* pour l'Amérique du Nord, nous proposons la nouvelle combinaison *M. hitchcockiana* (Elvander) Brouillet & Gornall.

Key words: *Micranthes*, North America, *Saxifraga*, Saxifragaceae.

Recent phylogenetic studies (summarized in Soltis et al., 2001) have shown that *Saxifraga* L., as currently understood, must be divided into two distinct genera: *Saxifraga* and *Micranthes* Haworth, a division that is supported by morphological characters (Brouillet & Gornall, 2007) such as the scapose stems, reticulate pollen, carpels connate less than half their length, and unitegmic ovules. *Micranthes* includes 68 to 93 species, depending on the taxonomy used, of which 45 are North American. The transfer from *Saxifraga* to *Micranthes* of 16 North American taxa belonging to the latter was done by Brouillet and Gornall (2008) within the framework of preparing the treatment of the genus for the Flora of North America project. A list of *Micranthes* species for the continent was also provided, but *S. hitchcockiana* Elvander was unwittingly left out. We provide here the omitted new combination in *Micranthes* for this taxon.

Micranthes hitchcockiana (Elvander) Brouillet & Gornall, comb. nov. Basionym: *Saxifraga hitchcockiana* Elvander, Syst. Bot. Monogr. 3: 34. 1984, replacement name for *Saxifraga occidentalis* S. Watson var. *latipetiolata* C. L. Hitchcock, Vasc. Pl. Pacific Northw. 3: 49. 1961, non *Saxifraga latepetiolata* Willkomm, Prodr. Fl. Hispan. 3: 120. 1874. TYPE: U.S.A. Oregon: Clatsop Co., Saddle Mtn., 20 June 1915, *W. M. Gorman 3561* (holotype, WTU not seen).

Hitchcock (1961) first described *Micranthes hitchcockiana* as variety *latipetiolata* of *Saxifraga occidentalis*. Elvander (1984) noted, however, the discordance of this variety within *S. occidentalis* of subsection *Nivali-virginienses* Engler & Irmscher, and its greater affinities to members of subsection *Integrifoliae* Engler & Irmscher, including *M. apetala* (Piper) Small, *M. aprica* (Greene) Small, *M. californica* (Greene) Small, *M. integrifolia* (Hooker) Small, *M. nidifica* (Greene) Small, *M. oregana* (Howell) Small, *M. rhomboidea* (Greene) Small, *M. subapetala* (E. E. Nelson) Small, and *M. tempestiva* (Elvander & Denton) Brouillet & Gornall. Elvander therefore raised the taxon to the rank of species. Perkins (1978) and Elvander (1984) hypothesized that the taxon originated through hybridization between *M. rufidula* Small and *M. oregana*. However, this hypothesis has yet to be evaluated. The species is restricted to wet rocks and ledges on mountaintop balds in Oregon.

Acknowledgments. The authors thank Jim Zarucchi, Missouri Botanical Garden, for having alerted us to the missing taxon and for comments on the manuscript; Victoria C. Hollowell, Missouri Botanical Garden, for useful comments on the manuscript; and Kanchi Gandhi, Gray Herbarium of Harvard University, for his nomenclatural counsels.

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 doi: 10.3417/2008005

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A New Species of *Senna* (Leguminosae, Caesalpinioideae) from Eastern Brazil

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Abstract. A new species of *Senna* sect. *Chamaefistula* (DC. ex Colladon) H. S. Irwin & Barneby is described and illustrated under the name *S. bracteosa* D. Cardoso & L. P. Queiroz. This new species belongs to series *Laxiflorae* (Bentham) H. S. Irwin & Barneby and is related to *S. lechriosperma* H. S. Irwin & Barneby, both presenting a relatively wide pod (8–10 mm wide) and seeds transversely arranged inside the pod. It is distinguished from *S. lechriosperma* and from any other species of the series *Laxiflorae* by the lanate indument of the pod, larger bracts, larger flowers, the sepals densely tomentose, and the stamens glabrous. *Senna bracteosa* seems to be endemic to relictual hills surrounded by caatinga vegetation in the northeastern region of the state of Bahia, near the towns of Quijingue and Tucano, in eastern Brazil.

Key words: Brazil, caatinga, IUCN Red List, Leguminosae, *Senna*.

Senna P. Miller is a large and diverse genus that is widespread over tropical and subtropical regions of the world (Lewis et al., 2005). It was formerly included in the genus *Cassia* L. (Irwin & Turner, 1960), but subsequent works subdivided this large genus into *Cassia* s. str., *Chamaecrista* Moench, and *Senna* (Irwin & Barneby, 1981, 1982). Recent phylogenetic studies (Bruneau et al., 2001; Herendeen et al., 2003; Marazzi et al., 2006) based on molecular and morphological data supported the monophyly of *Senna*, although most of its sections were not supported as monophyletic (Marazzi et al., 2006). *Senna* may be differentiated from *Cassia* and *Chamaecrista* by a combination of characters, including dimorphic stamens, but filaments of the abaxial stamens are never sigmoidally bent, bracteoles are absent, and fruits are indehiscent or not, but never elastically dehiscent.

The genus embraces about 350 species and is more diverse in the New World, where about 80% of its species are found (Irwin & Barneby, 1982; Lewis et al., 2005). For the Brazilian state of Bahia, Lewis (1987) surveyed 40 species. *Senna* is floristically important in the caatinga biome, with 19 species and six additional infraspecific taxa surveyed by Queiroz (2006), eight of which are considered as endemic to this biome.

Considering that the flora of the caatinga is poorly studied in comparison to evergreen, moist forests (Queiroz et al., 2006), it is not surprising to find new species in the caatinga biome. During a floristic survey in caatinga in the northeastern region of Bahia state, a new species was found, and it is here described and illustrated.

Senna bracteosa D. Cardoso & L. P. Queiroz, sp. nov. TYPE: Brazil. Bahia: Quijingue, Serra das Candeias, a ca. de 5 km W do Povoado Quixaba do Mandacaru, no limite com o mun. de Tucano, 10°55′20″S, 39°04′59″W, 573 m, 8 July 2006, *D. Cardoso & T. M. Santana 1306* (holotype, HUEFS; isotypes, BRIT, CEPEC, HUEFS, K, MBM, MO, NY, RB, SP, SPF). Figure 1.

Senna bracteosa D. Cardoso & L. P. Queiroz, inter species *Sennae* seriei *Laxiflorum* (Bentham) H. S. Irwin & Barneby fructibus latioribus (8–10 mm) et seminibus transverse dispositis ad *S. lechriospermam* H. S. Irwin & Barneby accedens, sed fructibus dense lanatis, bracteis longioribus (15–20 mm, non 2.5–6 mm) latioribusque (8–10 mm, non 1.5–2 mm), sepalis dense tomentosis et staminibus glabris differt.

Shrub 1.6–2 m tall, densely foliate, foliage deciduous in the dry season, young stems densely tomentose to villous with tan, long, patent to erect, curled hairs. Stipules foliaceous, 14–18 × 6–9 mm, reflexed against stem, reniform, contracted at the apex in a slender acumen, base produced in a wide orbicular auricle, main veins radially diverging from the point of attachment, densely tomentose on both faces. Leaves 7.3–18 cm, paripinnate; petiole 13–31 mm, with a scarcely differentiated pulvinus ca. 1.5–2 mm; rachis 27–74 mm, segments between leaflets 6–21 mm; nectaries present between all pairs of leaflets, stipitate, stipe ca. 0.8 mm, tomentose, the fusiform secretory body 0.8–1.8 mm, orangish yellow; pulvinules 0.7–1.5 mm, densely tomentose; leaflets in 4 or 5 pairs, papyraceous, bicolored, adaxial surface

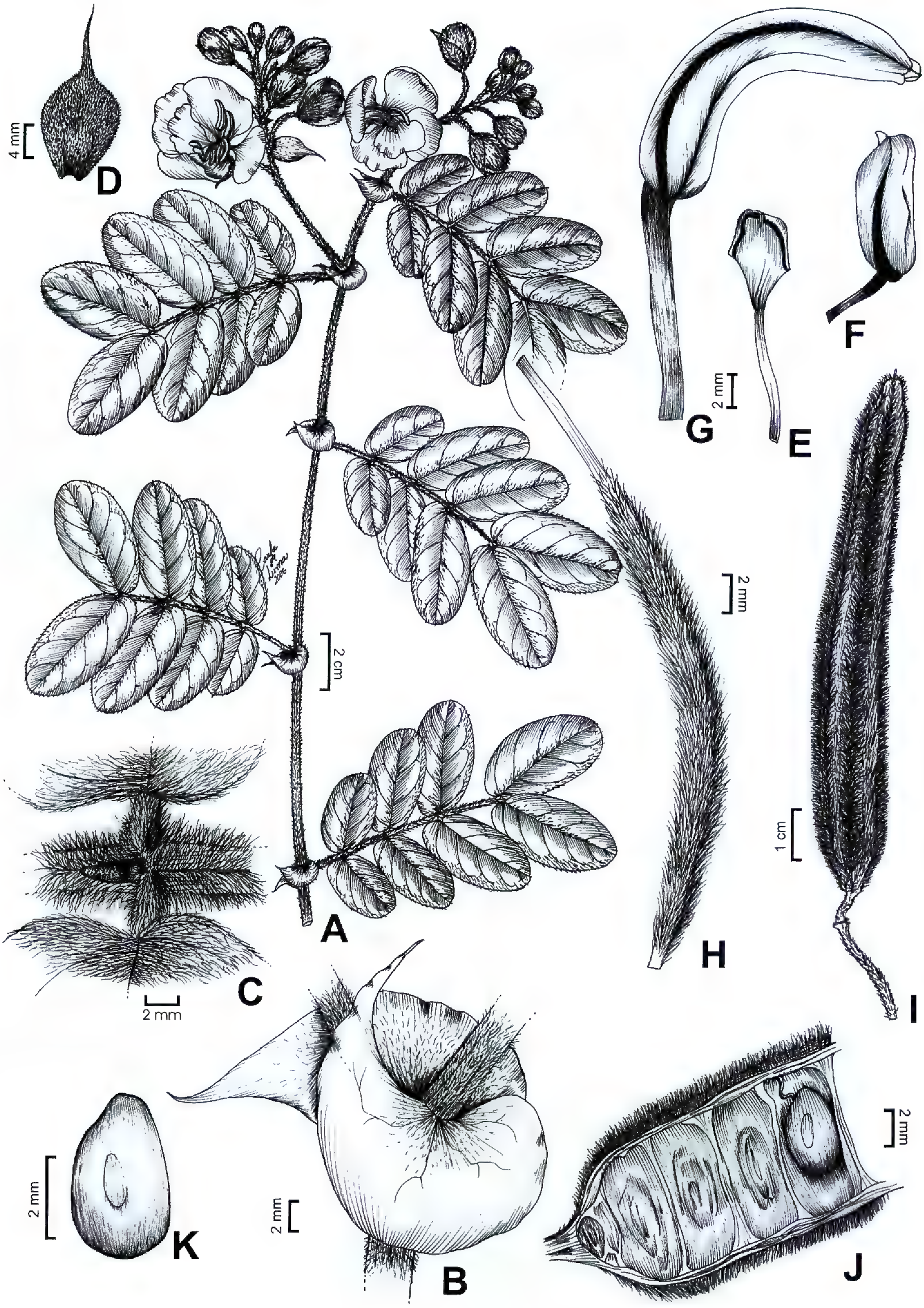

Figure 1. *Senna bracteosa* D. Cardoso & L. P. Queiroz. —A. Flowering branch. —B. Detail of the stipules. —C. Detail of a foliar nectary. —D. Bract. —E. Staminode. —F. Adaxial stamen. —G. Central abaxial stamen. —H. Pistil. —I. Pod. —J. Inner view of the pod showing the seed chambers and seed arrangement. —K. Seed. A–H from *D. Cardoso & T. M. Santana 1306* (HUEFS); I–K from *D. Cardoso et al. 874* (HUEFS).

dull green, sparsely tomentose, denser when young, abaxial surface cinereous, brownish tan on the main vein, densely tomentose with canescent, long, adpressed to patent curled hairs, the distal pair larger, obliquely elliptic-obovate, 4.3–7.2 × 1.9–3.4 cm, ca. 2.2× as long as wide, apex mucronulate, margins slightly revolute, midrib slightly eccentric toward base, becoming median toward apex, secondary veins in 9 to 11 pairs, camptodromous, raised on the abaxial surface, tertiary venation inconspicuous. Racemes 3–7 cm, corymbose, ca. 8- to 12-flowered, axillary in distal leaves; peduncles 2.5–4.5 cm; bracts 15–20 × 8–10 mm, covering the bud, early deciduous, obovate to suborbicular, apex stout caudate, densely tomentose dorsally; pedicels 25–32 mm, subtended laterally at the base by a stipitate, narrowly fusiform nectary 2–3.5 mm; flower buds light brown, obliquely obovoid, densely tomentose. Flowers 5.5–7.5 cm diam.; sepals yellowish green, obovate, concave, strongly graduated, the outermost one 18–20 mm, densely tomentose on the outer surface, the innermost 21–25 mm, externally sericeous only in the portion not covered in the bud by the outer sepals; petals bright yellow, sparsely sericeous dorsally from the base to the median portion and sometimes along the veins, the 3 abaxial petals 28–35 × 25–30 mm, ± symmetrically obovate-flabellate, the 2 abaxial ones larger, 35–43 × 28–35 mm, concave; staminodes 3, ca. 10 mm, white with blackish margins; fertile stamens 7, filaments glabrous, those of 4 median stamens 2–4 mm, that of the central abaxial one ca. 0.9 mm, and those of the 2 latero-abaxial ones dilated, ca. 1.2 × 1.5–2 mm; anthers glabrous, orangish yellow, black in the grooves, apex extending in a divaricate, 2-porose beak, anthers of the 4 median stamens straight or almost so, 6–8 mm, beak 0.5–0.7 mm, that of the centric stamen slightly incurved, ca. 11 mm, beak ca. 1 mm, those of the 2 latero-abaxial ones lunately incurved, ca. 14 mm, beak ca. 1 mm; ovary pale green, 19–21 mm, densely sericeous, ovules 37 to 43; style 8–12 mm, slightly incurved; stigma truncate. Legume 8.2–13.3 × 0.8–1 cm, linear, straight or incurved, compressed, slightly undulate, apex obtuse, mucronate, stipitate, stipe densely sericeous, ca. 6 mm, margins bicarinate, lanate, provided with long (ca. 2 mm), erect, straight hairs; valves slightly convex, stiffly chartaceous, scarcely constricted between the seeds, brown, pilose, provided with long, erect, sparse hairs, a single nerve running lengthwise parallel to the sutures, slightly displaced from center toward the upper margin, covered by hairs similar to those found on the margins; interseminal septa 3–4 mm apart, the seed locules broader than long. Seeds ca. 4 × 2 mm, oblong-obovoid, transverse to long axis of the pod; testa evenly brown; areole oblong-elliptic, ca. 2 × 0.5 mm.

Distribution, habitat, and ecology. *Senna bracteosa* was found only in the Serra das Candeias, a set of relictual hills ranging from 570 to 630 m, located along the boundaries of the municipalities of Tucano and Quijingue in northeastern Bahia. It occurs in dense scrub vegetation of caatinga, characterized by low deciduous trees and shrubs and a profusion of lianas and vines. The soil is mostly clay with granite outcrops.

IUCN Red List category. *Senna bracteosa* should be considered Critically Endangered (CR B1ab) according to IUCN Red List criteria (IUCN, 2001): extent of occurrence estimated to be less than 100 km^2 in severely fragmented and declining habitat.

Phenology. *Senna bracteosa* was found in flower in May and July and in fruit in July and November.

Etymology. The epithet "bracteosa" highlights one of the most distinctive characters of this species: the relatively large bracts covering the flower buds, which are much larger than those found in any other species of the series *Laxiflorae* in *Senna*.

Common name. "São-joão" (*D. Cardoso & T. M. Santana 1306*, HUEFS).

Discussion. *Senna bracteosa* belongs to series *Laxiflorae* of section *Chamaefistula* (DC. ex Colladon) H. S. Irwin & Barneby. Recent phylogenetic studies in *Senna* based on three chloroplast DNA regions (*rpS16*, *rpL16*, and *matK*) did not support the monophyly of the section *Chamaefistula* but strongly support the monophyly of the series *Laxiflorae* (Marazzi et al., 2006). This series is characterized by a rusty pubescence, the stipules mostly dilated, stipitate nectary glands between most or all of the leaflet pairs, the pedicels subtended laterally by a fusiform gland, and the pod crested lengthwise by a thick accessory nerve (Irwin & Barneby, 1982). In their revision of the American Cassiinae, Irwin and Barneby (1982) ascribed four species to series *Laxiflorae*, differentiated mostly by the number of leaflets, the distribution of foliar glands, and the shape of the pod and seed arrangement. A fifth species, *S. phlebadenia* H. S. Irwin & Barneby, was later added by the same authors (Irwin & Barneby, 1985).

Among the five species of series *Laxiflorae*, *Senna bracteosa* presents greater affinity with *S. lechriosperma* especially because they share a wider pod (8–10 mm wide) with seed chambers wider than long and a particular kind of arrangement of the seeds that lie transversely to the main axis of the pod. In addition, both species occur in the caatinga biome. *Senna bracteosa* can be distinguished from *S. lechriosperma* by its larger sepals (18–25 mm long in *S. bracteosa* vs.

4–15 mm long in *S. lechriosperma*), larger flowers (5.5–7.5 cm vs. 4–5.1 cm diam., respectively), bracts larger (15–20 mm vs. 2.5–6 mm, respectively) and densely tomentose dorsally (vs. almost glabrous), glabrous filaments (vs. pilosulous in *S. lechriosperma*), and the densely tomentose valves of the pods (vs. glabrescent in *S. lechriosperma*).

The geographical distributions of *Senna lechriosperma* and *S. bracteosa* do not overlap. The former has a wider range to the northwest from the left margin of the São Francisco River, in the Brazilian states of Maranhão, Piauí, Ceará, and Pernambuco (Irwin & Barneby, 1982), and was recently collected by us (*L. P. Queiroz et al. 9630*, HUEFS) at the northwestern corner of the state of Bahia, near the border with Piauí. In contrast, *S. bracteosa* was collected only in the northeastern region of Bahia.

Senna bracteosa seems very similar to *S. australis* (Vellozo) H. S. Irwin & Barneby and *S. velutina* (Vogel) H. S. Irwin & Barneby (both belonging to the series *Laxiflorae*) because they share branches and leaves that are densely tomentose. Nevertheless, these two species do not present fruits as densely lanate as found in *S. bracteosa*. Additionally, *S. australis* and *S. velutina* present narrower pods (3–5 mm wide) with seed chambers longer than wide and seeds vertically arranged in these chambers. *Senna australis* is a plant from the coastal plain below 30 m altitude, ranging from southern Bahia to Rio de Janeiro, while *S. velutina* occurs in cerrado vegetation of the central Brazilian Plateau, ranging from the state of Goiás to western Bolivia and southern Paraguay (Irwin & Barneby, 1982).

Paratypes. BRAZIL. **Bahia:** Quijingue, Serra das Candeias, a ca. de 5 km W do Povoado Quixaba do Mandacaru, 10°55′20″S, 39°04′59″W, 350–632 m, 15 May 2005, *D. Cardoso & T. M. Santana 530* (HUEFS, P, RB), 13 Nov. 2005, *D. Cardoso, J. G. Carvalho-Sobrinho, P. Oinonen & M. Jönsson 874* (CEPEC, HUEFS, MBM, SPF).

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Validation of the Name *Anthurium loretense* (Araceae)

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ABSTRACT. The new species *Anthurium loretense* Croat was invalidly published in 1991, lacking a Latin diagnosis. This oversight is corrected with the validation of the name.

Key words: *Anthurium*, Araceae.

In taxonomic revision of section *Pachyneurium* Schott in *Anthurium* Schott (Araceae), the new species *A. loretense* Croat was mistakenly published without a Latin diagnosis. According to Article 32.1(d) of the *International Code of Botanical Nomenclature* (McNeill, 2006), the name was invalid. A diagnosis is provided herein to validate *A. lorentense*.

Anthurium loretense Croat, sp. nov. TYPE: Peru. Loreto: Prov. Maynas, Dist. Iquitos, Río Mamon & Quebrada Mamoncillo, 1 km from Río Nanay, 200 m, *T. B. Croat 51226* (holotype, MO 2813874-80; isotypes, B, CAS, DUKE, F, K, MO, NY, US, USM, VEN).

Planta epiphytica; internodia brevia, (1–)2.5–5 cm diam.; cataphyllum 4–6 cm longum, unciformis; petiolus 2.5–10 (–16) cm longus, in litteram D formatus vel quadrangularis, adaxialiter applanatus vel sulcatus, abaxialiter 3 ad 8 costatus; lamina obovata vel oblanceolata vel elliptica, (36–)56–120(–168) cm longa, 30–50 cm lata, nervis primariis lateralibus utrinque 10 ad 21; inflorescentia plerumque pendens; spatha 5.5–24(–35) cm longa, 1.2–3 cm lata; spadix marronius vel rubello-violaceus, 7.5–28 cm longus, 6–11 mm diam.; baccae purpureo-violaceae.

Described from Peru, the distribution of *Anthurium loretense* also extends into Ecuador and Amazonian Brazil. The new species is distinguished by its hook-shaped cataphylls and D-shaped to quadrangular petioles. Its leaves are large, to 120 cm or more in length and to 50 cm or more in width, with the blades obovate to oblanceolate to elliptic. The inflorescences are spreading to pendent and long-pedunculate, with peduncles to 80 cm. The spathe is 2/3 to 3/4 the length of the spadix and parallel to the maroon to reddish violet spadix. A complete English description of the species as well as discussion, exsiccatae, and photographs can be found in the taxonomic revision of *Anthurium* sect. *Pachyneurium* Schott (Croat, 1991: figs. 17, 182, 186).

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Validation of the Name *Anthurium nutibarense* (Araceae)

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Abstract. The new species *Anthurium nutibarense* Croat (Araceae) from Colombia was published invalidly in 2005, not specifically designating the location of the holotype. This oversight is corrected with the validation of the name *Anthurium nutibarense* Croat.

Key words: *Anthurium*, Araceae, Colombia.

In a review of the *Anthurium splendidum* W. Bull (Araceae) complex, the name *A. nutibarense* Croat was mistakenly published without designating the location of the holotype (see Croat, 2005: 61–62, fig. 4A, B), rendering the name invalid according to Article 37.6 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006). The holotype and isotypes are provided here in order to validate the name.

Anthurium nutibarense Croat, sp. nov. TYPE: Colombia. Antioquia: Frontino, region of Murrí, Nutibara-La Blanquita, 19.4 km from center of Nutibara, 6°40′N, 76°26′W, 1460 m, 10 Feb. 1989, *J. M. MacDougal, D. Restrepo & D. S. Sylva 3867* (holotype, MO 3670528; isotypes, HUA, JAUM).

The species is endemic to Colombia and is distinguished by its terrestrial habit, short internodes, prominently ridged petioles, and conspicuously bullate, ovate-sagittate blades with the veins of the abaxial surface bearing wings with scaly appendages. It is closely related to *Anthurium splendidum*, a species known from lower elevations in Tropical pluvial forest (T-pf) (Holdridge, 1971). Both species share more or less bullate blades of similar shape and color with a certain degree of variously winged ribs. *Anthurium splendidum* differs in having a matte, somewhat frosty abaxial blade surface and lacking dark granular projections, as well as the adaxial surface being pale short-lineate.

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New Endemic Species of *Anthurium* (Araceae) from Río Huallaga, Peru

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ABSTRACT. Ten new species of *Anthurium* (Araceae) are described from Amazonian Peru. Nine of the species, *A. carpishense* Croat, *A. cerrateae* Croat & Lingán, *A. debilipeltatum* Croat, *A. josei* Croat, *A. linganii* Croat, *A. longissimilobum* Croat, *A. pradoense* Croat, *A. puberulum* Croat & Lingán, and *A. timplowmanii* Croat, are from a single area of high endemism in the southern Huallaga River Valley of Huánuco Department near Tingo María, and the area between Tingo María and La Divisora; and one species, *A. pulcachense* Croat, is endemic to an area in the middle Río Huallaga valley in San Martín, Peru.

Key words: *Anthurium*, Araceae, Huánuco, IUCN Red List, Peru, Río Huallaga, San Martín.

The aroid flora of Peru is still poorly known despite the publication of the Araceae for the *Catalogue of the Flowering Plants and Gymnosperms of Peru* (Croat, 1993). Though not a thorough revision of the species occurring in Peru, this list took into account all species of plants described for Peru, as well as all described species represented only by herbarium specimens, which were verified by experts for each family. The checklist contained 210 species of Araceae for Peru, but it did not include any unpublished names and many species remained to be described. In most modern taxonomic revisions of groups of Neotropical Araceae, increase in the aroid flora is not unusual. It is expected that any thorough study of Peru will probably bring the total number of Araceae closer to 300 species or more. An IUCN Red List category is listed with each species (IUCN Red List, <http://www.iucnredlist.org/info/categories_criteria2001>).

1. Anthurium carpishense Croat, sp. nov. TYPE: Peru. Huánuco: Prov. Huánuco, Distr. Chinchao, Cumbre de Carpish, 2750 m, 7 Feb. 1972, *J. Schunke-Vigo 5236* (holotype, MO-2250109; isotypes, COL, F, GH, IBE, NY, US, USM). Figure 1A, B.

Planta terrestris aut hemiepiphytica; internodia 3–7.4 cm longa, 5–10 mm diam.; cataphylla (2–)4.5–9.5 cm longa, in fibris pallidis persistentia; petiolus (13.4–)18–29 cm longus, sulcatus; lamina anguste ovato-cordata, (11–)16–28.5 cm longa, (8–)10.6–18 cm lata, rugosa; inflorescentia erecta; spatha lanceolata, reflexa, (3.2–)4–7 cm longa, 6–12 mm lata; spadix rubra, (1–)2–4.8 cm longa, (3–)5–7 mm diam.; stipes (0.8–)2.5–3.7 cm longus.

Terrestrial herb or hemiepiphyte, growing to 2 or 3 m; *internodes* 3–7.4 cm, 5–10 mm diam., drying dark olive-brown, soon light brown and closely blackish transverse-fissured; *cataphylls* (2–)4.5–9.5 cm, the uppermost intact, promptly weathering to a pale reticulum of fibers with some loose fibers persisting even at lower nodes; *petioles* (13.4–)18–29 cm, subterete, obtusely sulcate, drying deeply sulcate and pale yellow-brown; geniculum 10–15 mm, scarcely thicker than the petiole; *blades* narrowly ovate-sagittate, (11–)16–28.5 × (8–)10.6–18 cm, rugose, dark green and matte adaxially, paler and matte abaxially, drying greenish brown to yellow-brown adaxially, yellow-brown abaxially, narrowly acuminate at apex, sagittate at base; anterior lobe 8–21.5 cm; posterior lobes 3.2–7.5 cm, 3.4–7.5 cm wide midway, directed toward the base; sinus 2.5–7 cm deep, (0.5–)1–2.5 cm diam. midway, oblong or sometimes spatulate to V-shaped; *basal veins* usually 4 pairs, sometimes 5 or 6 pairs, 1st and often 2nd free to base, 3rd and higher coalesced 1.5–2 cm; posterior rib ± straight, barely or not at all naked along sinus; *midrib* drying narrowly triangular and paler adaxially, convex and paler abaxially; *primary lateral veins* 3 to 5 pairs, weakly raised in narrow valleys adaxially, convex abaxially, departing midrib at 35°–60°, straight to gradually curved to the collective veins; collective veins usually arising from the 1st basal vein, sometimes from the 2nd or rarely the 3rd pairs of basal veins, 2–8 mm from margin, equally as prominent as the primary lateral veins; all the veins on the abaxial surface but especially primary lateral veins and tertiary veins pustular-hispidulous on drying. INFLORESCENCE erect; *peduncle* 6.7–12.2 cm; *spathe* pinkish yellow to pinkish green, lanceolate,

Figure 1. A, B. *Anthurium carpishense* Croat. Herbarium specimens. —A. *Schunke 5236*. —B. *Luteyn & Lebron-Luteyn 5470*. —C. *Anthurium cerrateae* Croat & Lingán (from the holo/isotype *Ferreyra 17008A*, MO). —D. *Anthurium debilipeltatum* Croat (from the holo/isotype *Croat 57966*, MO).

reflexed, (3.2–)4–7 × 6–12 mm; stipe (0.8–)2.5–3.7 cm, drying 1–2 mm diam.; *spadix* red, (1–)2–4.8 cm, (3–)5–7 mm diam., nearly cylindric, scarcely tapered toward apex, bluntly rounded at apex. Flowers 5 to 8 visible per spiral, 4-lobed, ca. 2.6 × 2.2 mm; lateral tepals ± shield-shaped, the outer margin narrowly rounded, inner margin broadly rounded; stamens held at surface of tepals in a close, usually

contiguous circle around the style; anthers yellow; stigma elliptic, ca. 0.2 mm. INFRUCTESCENCE not seen.

Distribution and habitat. *Anthurium carpishense* is endemic to Peru, known only from the Cumbre de Carpish (hence the epithet "carpishense"), from the Department of Huánuco in the Districts of Chinchao and Rupa Rupa, at 700 to 2750 m elevation, growing in shady areas in Premontane wet forest transition to Tropical (P-wf/T) according to Holdridge (1967).

IUCN Red List category. Conservation for *Anthurium carpishense* must be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001), because the species is known from only three collections. It is known from two localities in Peru, and it may prove to be more widespread since it is similar to a collection in Colombia (*Martin L. Grant 9729*) from Cundinamarca (N side of Quebrada San Rogue, Río Blanco Valley, 10 km W of Gutierez, 45 km S of Bogotá, Station 42, 2500 m, 27 July 1944). However, that collection, in addition to being quite disjunct, was reported as having a maroon spadix rather than a red spadix.

Discussion. *Anthurium carpishense* is characterized by its mostly terrestrial vine-like habit; persistent cataphyll fibers; narrowly ovate-cordate, coarsely bullate, greenish brown-drying rugose blades with pustular-hispidulous veins on the abaxial surface; and especially by the long-stipitate red spadix. Otherwise, the species is confused with no other and appears to have no close relatives in Peru. It is a member of *Anthurium* sect. *Xialophyllium* Schott (Croat & Sheffer, 1983).

Paratypes. PERU. **Huánuco:** Prov. Leoncio Prado, Distr. Rupa Rupa, vic. of Tingo María along rd. to Huánuco, 40 min. from Tingo María, ca. 9°18′S, 75°59′W, 700 m, 21 Mar. 1982, *King 342* (F); Prov. Huánuco, trail from S entrance of Carpish tunnel to crest of ridge, 2743 m, 27 Feb. 1978, *Luteyn & Lebron-Luteyn 5470* (NY).

2. Anthurium cerrateae Croat & Lingán, sp. nov. TYPE: Peru. Huánuco: Prov. Leoncio Prado, left bank of Monzón, near Tingo María, 15 Mar. 1967, *R. Ferreyra 17008A* (holotype, MO-5988713; isotypes, COL, F, HUT, K, NY, QCNE, UB, US, USM). Figure 1C.

Cataphylla persistentia intacta; petiolus 29.8–50.2 cm longus, 0.5–0.7 cm diam.; lamina 29.6–64.3 cm longa, 22.2–45 cm lata, late ovata, profunde cordata, nervis primariis lateralibus utrinque 3 ad 6(ad 7); pedunculus 13.2–38.1 cm longus, 0.5–0.9 cm diam.; spatha viridis, 8.1–14.5 cm longa, 1.2–2.3 cm lata; spadix 16.1–25.4 cm longa, 0.7–1 cm diam. ad basim, stipitata, stipite 0.7–1.9 cm.

Description based on dried material. Habit unknown, possibly terrestrial; stem unknown; *cataphylls* triangular-lanceolate, bluntly 1-ribbed on the upper 1/3, obtuse at apex, 10.9 cm, subcoriaceous, reddish brown, persisting intact. LEAVES erect to weakly spreading; *petioles* 29.8–50.2 cm, 0.5–0.7 cm diam., obtusely and broadly sulcate, sometimes bluntly 4-ribbed abaxially, green; sheath 1.7–3.2 cm; geniculum 1.4–2 cm; *blades* subcoriaceous, 29.6–64.3 × 22.2–45 cm, wider in the middle, widely ovate, abruptly acuminate at apex, deeply cordate at base, drying yellowish brown to grayish; margins convex; posterior lobes rounded, convergent, sometimes overlapping, 9–21.4 cm; sinus hippocrepiform to obovate; *midrib* acutely raised in both surfaces, sometimes only concave adaxially; *primary lateral veins* 3 to 6(to 7) pairs per side, straight to recurved near the collective veins, departing midrib at 40°–50°; basal veins (6 to)7 or 8(to 9) pairs, fused 3rd(4th) to 7th or 8th to the basal ribs; *posterior ribs* 2.1–5.5 cm, slightly curved, not naked; collective veins arising from the 3rd or 4th basal veins, generally very close to the margins, inconspicuous to 7 mm from the margins. INFLORESCENCE erect; *peduncle* 13.2–38.1 cm, 0.5–0.9 cm diam., greenish, 0.4–0.8× longer than the petiole; *spathe* subcoriaceous, green, persistent, spreading to reflexed, 8.1–14.5 × 1.2–2.3 cm, lanceolate to oblong-lanceolate, acute to acuminate at apex, cordate at base; *spadix* purplish or purple to grayish green, long-tapered, 16.1–25.4 cm, 0.7–1 cm diam. at base, 0.4 cm diam. at apex; stipe greenish, 0.7–1.9 cm in front, 0.2–0.5 cm in back. Flowers rhombic, margins straight, ca. 3 × 2 mm; 6 to 10 flowers visible on the principal spiral, 6 flowers visible on the alternate spiral; tepals with the inner margins convex; *pistils* obovate; stigmas elliptic; stamens with anthers protruding at anthesis; anthers closely clustered over stigma; thecae slightly divaricate. INFRUCTESCENCE not seen.

Distribution and habitat. *Anthurium cerrateae* is known from Leoncio Prado Province, near Tingo María, in the Tropical wet forest transition to Premontane (T-wf/P).

IUCN Red List category. Conservation for *Anthurium cerrateae* must be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001). It is known from only the type specimen, and thus remains in need of further investigation against future conservation efforts.

Etymology. *Anthurium cerrateae* is named in honor of Emma Cerrate de Ferreyra for her remarkable contribution to the knowledge of the Peruvian flora. Dr. Cerrate and her husband Ramón Ferreyra have

both made many important collections of Araceae during their many years of collecting in Peru.

Discussion. The species is a member of *Anthurium* sect. *Calomystrium* Schott and is distinguished by its widely ovate leaves, cataphylls obtuse at apex, green spathe, and long tapered purplish spadix.

3. Anthurium debilipeltatum Croat, sp. nov. TYPE: Peru. Huánuco: along steep cliffs W of Río Huallaga on rd. to airport, 9°14′S, 76°01′W, 675 m, 5 Apr. 1984, *T. B. Croat 57966* (holotype, MO-3189494; isotypes, B, CAS, COL, CUZ, F, GH, K, NY, QCNE, RSA, TEX, US, VEN). Figures 1D, 2A, B.

Herba plerumque epipetrica; internodia brevia, 1–2 cm diam.; cataphylla in fibris tenuibus persistentia; petiolus 5–18 cm longus, 1–3 mm diam., teres; lamina lanceolata vel oblongo-elliptica, ad basim obtusa vel rotundata, 13–27 cm longa, 1.5–4 cm lata; nervis primariis lateralibus utrinque 15–25; nervo collectivo prope basim exoriente; spatha lanceolata, 2.5–5 cm longa, 5–7 mm lata; spadix luteo-viridis vel cinereo-viridis, 4.4–7.4 cm longa, 2–5 mm diam.; baccae albae, 3–5 mm diam.

Epipetric or occasionally epiphytic; stem less than 10 cm; *internodes* shorter than broad, ca. 2–3 mm, 1–2 cm diam.; leaf scars obscured by cataphyll fibers; roots numerous, densely pubescent, elongate, blunt at apex, drying grayish brown to dark brown, 24–40 cm, 2–4 mm diam.; *cataphylls* thin, chartaceous, 4–7 cm, acuminate at apex, drying tan, persisting as fine linear fibers with intact fragments occasionally present. LEAVES pendent to suberect; *petioles* 5–18 cm, 1–3 mm diam., terete, drying yellowish green, inserting slightly above the leaf base; geniculum concolorous and thicker than petiole, 0.5–1.5 cm; *blades* lanceolate to oblong-elliptic, subcoriaceous to coriaceous, gradually acuminate at apex, obtuse to rounded at base, 13–27 × 1.5–4 cm, broadest in the lower 1/3 or near middle, adaxial surface dull green, abaxial surface shiny green, drying bicolorous yellowish green; *midrib* weakly and narrowly raised adaxially, convexly raised abaxially, drying paler than surface on both sides; *primary lateral veins* 15 to 25 pairs per side, departing midrib at 80°–45°, mostly straight to the collective vein, scarcely or not raised on either surface when fresh, drying weakly raised on both surfaces; interprimary veins almost as conspicuous as primary lateral veins when dried; lesser veins visible when dried; collective vein arising from the base, 1–4 mm from margin. INFLORESCENCES erect; *peduncle* 5–19 cm, drying ca. 1 mm diam., drying light yellowish green; *spathe* lanceolate, 2.5–5 × 0.5–0.7 cm, acuminate at apex, chartaceous, reflexed, medium green, drying green, broadest in lower 1/3; stipe 3–9 mm in front, 2–5 mm in back; *spadix* usually weakly tapered to cylindrical, 4.4–7.4 cm, 2–5 mm diam. near base, 2–3 mm diam. near apex, broadest at the base, yellowish green to grayish green, drying yellowish green. Flowers square, 17–21 mm in both directions, sides straight to smoothly or jaggedly sigmoid, 4 or 5 flowers visible in principal spiral, 3 or 4 flowers visible in alternate spiral; tepals matte, lateral tepals 1–1.2 mm wide, inner margins straight to weakly convex, outer margins angled, 2-sided; *pistils* weakly exserted, drying pale green; stigma ellipsoid, 0.4–0.7 mm, drying dark brown. INFRUCTESCENCE with spathe absent; spadix with berries in the basal portion only; *berries* depressed-globose, 2–2.5 mm, 3–5 mm diam., white, drying pale green, apex broadly rounded; seeds 2, obovoid-flattened, 2.2–2.6 mm, 2.2–3.5 mm diam., ca. 1.5 mm thick, pale brown with white-speckled surface.

Distribution and habitat. *Anthurium debilipeltatum* is endemic to Peru in the Department of Huánuco, known only from the limestone cliffs in the hills east of the Río Huallaga near Tingo María at 675 to 800 m elevation in Premontane wet forest transition to Tropical (P-wf/T) life zone.

IUCN Red List category. Conservation for *Anthurium debilipeltatum* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the area of the type locality, it is not yet known from other sites in Peru. The type locality is extremely rocky and unsuited to agriculture, so there is a good chance that this region will be preserved. In addition, the species no doubt occurs in an adjacent area with the same type of vegetation that is already in a nature reserve around Cueva de las Lechuzas.

Discussion. *Anthurium debilipeltatum* is recognized by its limestone-loving habit; short stems with short internodes; cataphylls persisting as fine, mostly disorganized pale fibers; terete petioles, yellowish green drying; lanceolate to oblong-elliptic, gradually long acuminate blades that have the primary lateral veins scarcely raised or not on either surface; and obtuse to rounded leaf bases that extend somewhat beyond the petiole making the blade appear weakly peltate (hence the epithet "debilipeltatum").

The new species appears to have no close relatives and is one of several distinct species discovered in recent years from the craggy limestone cliffs in the vicinity of Tingo María, Peru. At least one of these species, *Anthurium reflexinervium* Croat, is a member of *Anthurium* sect. *Pachyneurium* Schott, but *A. debilipeltatum* is tentatively placed in section *Decurrentia* Croat. The species was first collected in 1971,

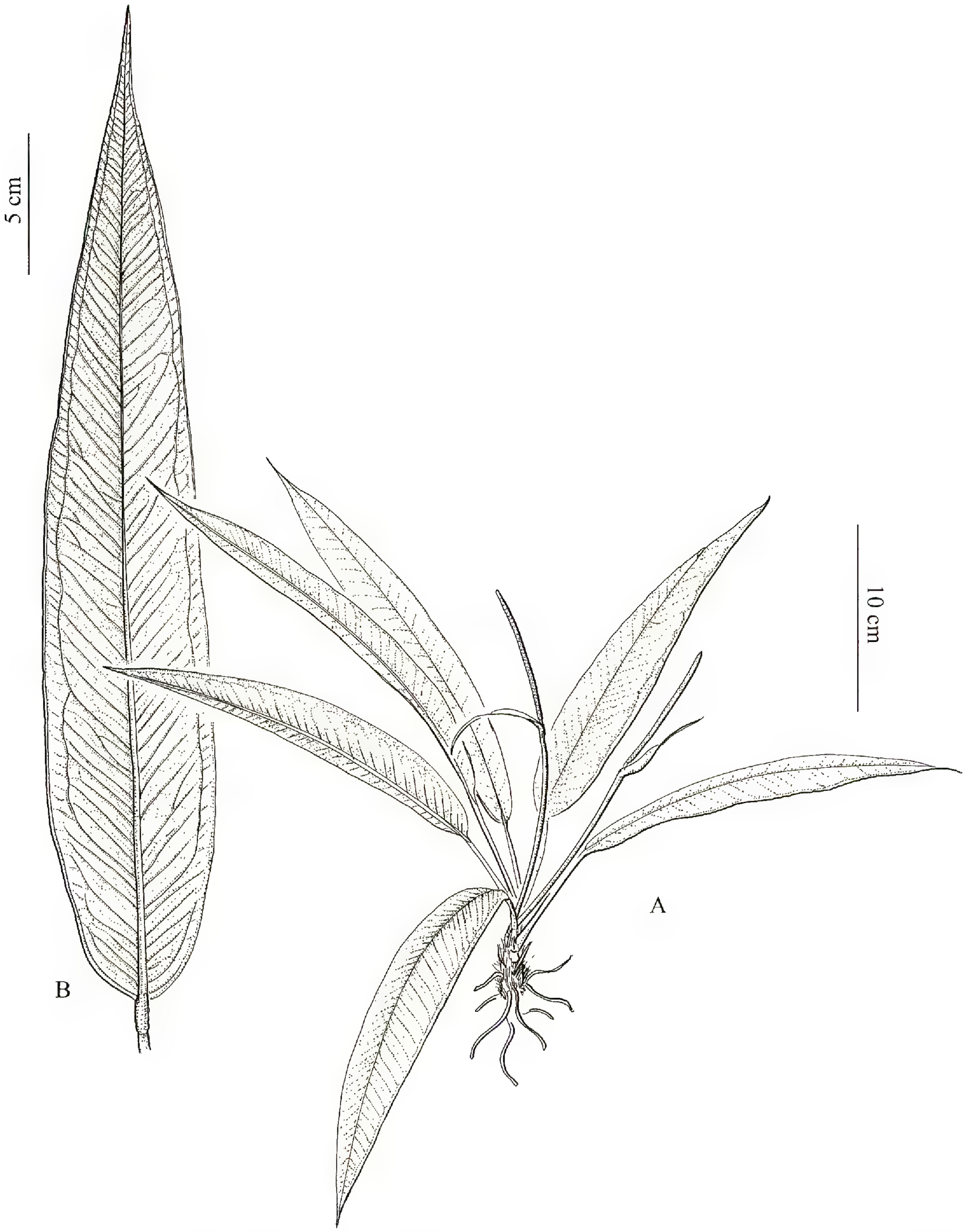

Figure 2. A, B. *Anthurium debilipeltatum* Croat. —A. Habit. —B. Leaf (abaxial view). Drawn from *Plowman & Ramirez 7570* by John Myers.

by the eminent Peruvian collector José Schunke-Vigo, who has collected many new Araceae especially from San Martín and Huánuco Departments.

Paratypes. PERU. **Huánuco:** On 60° rocky slope above Río Huallaga at Tingo Maria, 09°18′S, 076°00′W, 4 Oct. 1972, *Croat 21081* (MO); Leoncio Prado, Distr. Rupa Rupa, al oeste de Tingo Maria, cerro frente al Aeropuerto, 09°18′00″S, 075°59′00″W, 700–800 m, 3 Aug. 1978, *Schunke 10443* (CM, MO, USM); Jacintillo on left bank of Río Monzón, W of Tingo Maria, 09°11′00″S, 076°12′00″W, 750 m, 16 Apr. 1976, *Plowman 5900A* (GH, MO); Distr. Rupa Rupa, Tingo María, limestone hills opposite airport, 9°18′S, 75°59′W, 700–

780 m, 9 Dec. 1981, *Plowman, M. Ramírez & P. M. Rury 11257* (F, K, MO, USM); Distr. Rupa Rupa, al oeste de Tingo María (cerrito frente al aeropuerto), 680–700 m, 8 Nov. 1971, *Schunke 5131* (COL, F, G, GH, IBE, NY, US); Distr. Rupa Rupa, Tingo María and environs, limestone hills opposite airport, 750–800 m, 5 July 1978, *Plowman & M. Ramírez 7570* (AAU, F, K, MO, SEL, U, USM). **San Martín:** Mariscal Caceres, Distr. Campanilla, Carretera Marginal de la Selva, 7.4 km N of Pulcache, 07°43′S, 076°40′W, 900–950 m, 21 Dec. 1981, *Plowman & Schunke 11633* (K, MO).

4. Anthurium josei Croat, sp. nov. TYPE: Peru. Huánuco: Prov. Leoncio Prado, Distr. Hermilio Valdizán, near La Divisora, 1500–1600 m, 27 June 1976, *J. Schunke-Vigo 9426* (holotype, MO-2682086). Figure 3A, B.

Planta epiphytica, 30 cm; internodia brevia, 5–7 mm diam.; cataphylla 6 cm longa; petiolus 8.3–17.8 cm longus; lamina 14.1–21.4 cm longa, 3.1–4.2 cm lata, lobulis posterioribus 1.4–2.4 cm longis, 1.1–1.8 cm latis, nervis primariis lateralibus utrinque 5 ad 8; pedunculus ca. 7.5 cm longus; spadix ca. 6 cm longa, viridis, stipitata, stipite ca. 2.9 cm longo.

Epiphytic herb to 30 cm; stem short, subterete, drying brown; *internodes* very short, 5–7 mm diam.; roots dense, 1–2 mm diam.; *cataphylls* to 6 cm, acicular at apex, drying grayish green, soon weathering to fibers and only ca. 1 cm of the base of the fibers persisting, stramineous, thin. LEAVES erect to spreading; *petioles* 8.3–17.8 cm, 1–2 mm diam., semi-erect, terete, narrowly sulcate, drying medium gray-green; sheath 0.8 cm; geniculum 0.8–1.3 cm; *blades* 14.1–21.4 × 3.1–4.2 cm, 5.1× longer than wide, 1.4–1.6× longer than petioles, narrowly oblanceolate with short and narrow closely aligned posterior lobes and narrow sinus, broadest in the distal 1/3, gradually acuminate at apex, subcoriaceous, drying matte, grayish green on adaxial surface, grayish yellow-green on abaxial surface; posterior lobes 1.4–2.4 × 1.1–1.8 cm, directed toward the base, slightly longer than broad, broadly rounded to narrowly rounded at apex; sinus 8–20 mm deep, very narrow to closed with posterior lobes weakly overlapping; *midrib* weakly raised adaxially, drying paler than surface and weakly 3-ribbed near the base, prominently raised and paler abaxially, drying weakly and irregularly ribbed; *primary lateral veins* 5 to 8 pairs, straight, arising at 20°–40° angle; interprimary veins present; *basal veins* 4–5 pairs, the 1st pair free to the base, the 2nd pair almost free, the 3rd and 4th weakly fused into a posterior rib 3–7 mm; posterior rib not naked along the sinus; collective veins arising from the 1st pair of basal veins; tertiary veins prominulous abaxially, the surface somewhat granular on high magnification on drying. INFLORESCENCE erect; *peduncle* ca. 7.5 cm, drying like petioles, ca. 2 mm diam.; *spathe* erect-spreading, subcoriaceous, narrowly lanceolate, acute to apex, ca. 4 × 0.8 cm, greenish yellow; *spadix* ca. 6 cm, ca. 0.3 cm diam., cylindric, green; stipe to 2.9 cm, drying ca. 1 mm diam. Flowers square, sides straight, ca. 1 × 1 mm; 4 flowers visible in the principal spiral, 5 flowers visible in the alternate spiral; tepals 3-sided, inner margins broadly convex; stigmas slit-like; thecae slightly divaricate. INFRUCTESCENCE not seen.

Distribution and habitat. *Anthurium josei* is known only from the type locality in Huánuco Department and seems to be endemic to La Divisora area at 1500 to 1600 m elevation in Premontane wet forest transition to Tropical (P-wf/T).

IUCN Red List category. Conservation for *Anthurium josei* must be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001). Because the species is known only from a single collection, it remains in need of further investigation against future conservation efforts. The region of La Divisora is steep and has many endemic species. It is possible that the area might qualify for protected status.

Etymology. The species is named in honor of José Schunke-Vigo, currently living in Tochache Nuevo, who collected the type specimen and countless other wonderful specimens of Araceae over his long career of collecting in Peru, especially in Huánuco and San Martín. José Schunke-Vigo first gained his appreciation of the Peruvian flora from his grandfather, Carlos Schunke, who was also a well-known plant collector.

Discussion. *Anthurium josei* is placed in *Anthurium* sect. *Cardiolonchium* Schott and is distinguished by its long-petiolate, narrowly oblanceolate blades with short and narrow closely aligned posterior lobes and narrow sinus, and by its long-stipitate, cylindrical green spadix.

5. Anthurium linganii Croat, sp. nov. TYPE: Peru. Huánuco: Prov. Leoncio Prado, along rd. Tingo María–Pucallpa, 2.4 km N of San Isidro, 9°13′18″S, 75°49′40″, 891 m, 3 June 1998, *T. B. Croat & M. Sizemore 81672* (holotype, MO-4951778; isotypes, B, CAS, COL, F, K, NY, US, USM). Figures 3C, D, 4A.

Terrestris vel epiphytica; internodia brevia, 0.4–0.7 cm diam.; cataphylla 16.4–21.6 cm longa, in fibris persistentia; lamina 36.2–48.7 cm longa, 19.8–32.1 cm lata, anguste ovata, nervis primariis lateralibus utrinque 8 ad 12; pedunculus 24.3–35.6 cm longus, 0.3–0.6 cm diam.; spatha viridis, 8.6–9.3 cm longa, 2.3–2.6 cm lata, elliptico-lanceolata; spadix cylindrica, 6.4–8.4 cm longa, 0.5–0.6 cm diam.

Description based on dried material. Terrestrial or epiphyte; roots 1–3 mm diam., brownish white to dark

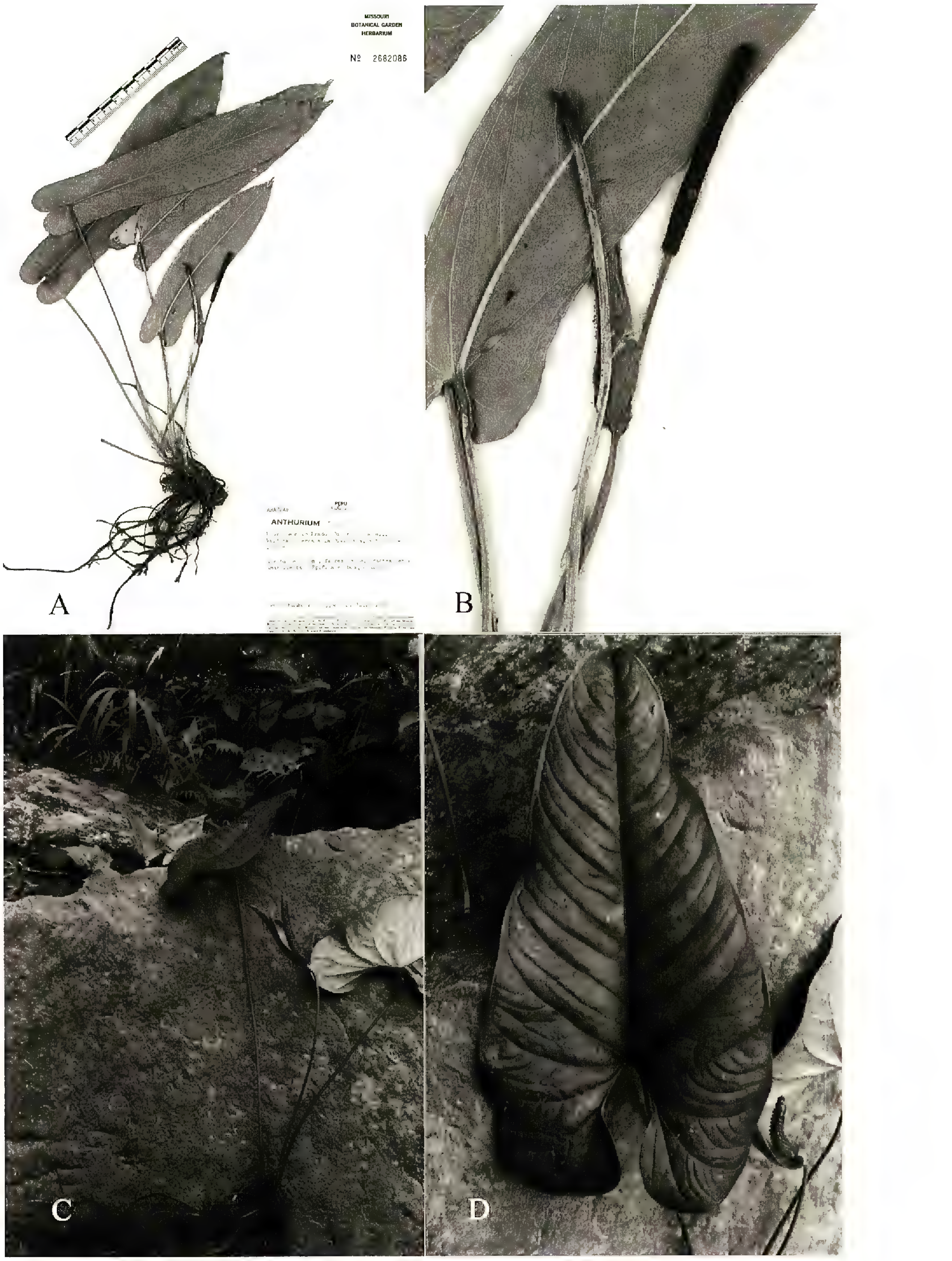

Figure 3. A, B. *Anthurium josei* Croat (from the holotype *Schunke 9426*, MO). —A. Habit. —B. Inflorescence, close up. C, D. *Anthurium linganii* Croat (from the holo/isotype *Croat & Sizemore 81672*, MO). —C. Habit. —D. Leaf (adaxial view) and inflorescence.

brown; stem 1.2–2.5 cm diam., terete, reddish brown; *internodes* short, 0.4–0.7 cm; *cataphylls* 16.4–21.6 cm, unribbed, subcoriaceous, triangular-oblong-lanceolate, reddish brown, promptly withered into a reddish brown fibrous network, densely persistent, sometimes with fragments of epidermis. LEAVES erect; *petioles* 34.7–75.1 cm, 0.3–0.7 cm diam., subterete, narrowly and obtusely sulcate, dark green and semiglossy; sheath

Figure 4. —A. *Anthurium linganii* Croat (from the holo/isotype *Croat & Sizemore 81672*, MO). Inflorescence. B, C. *Anthurium longissimilobum* Croat (*Croat 58354*, MO). —B. Leaf (adaxial view). —C. Leaf (adaxial view) and inflorescence, note the long and slender spadix. —D. *Anthurium puberulum* Croat & Lingán (from the holo/isotype *Croat & Sizemore 81704*, MO). Habit of type specimen.

1.6–2 cm; geniculum 1.2–1.8 cm; *blades* subcoriaceous, 36.2–48.7 × 19.8–32.1 cm, wider in the insertion of petiole or toward the base, narrowly ovate, semiglossy, acuminate at apex, deeply cordate at base, moderately bicolorous, dark green and glossy adaxially, drying brown, paler and semiglossy abaxially, drying dark brown; margins straight to weakly concave; posterior lobes oblong, directed toward the base,

8.4–13.2 cm; sinus hippocrepiform; *midrib* narrowly raised in valleys adaxially, acute and slightly paler abaxially; *primary lateral veins* 8 to 12 pairs per side, slightly recurved to ascending, raised adaxially in valleys, acutely raised abaxially, departing midrib at 55°–70°; tertiary veins in part sunken adaxially, raised abaxially; basal veins 6 to 7 pairs, fused 2nd (sometimes 1st or 3rd) to 6th or 7th to the basal ribs; *posterior ribs* 4.1–6.3 cm, slightly recurved, naked 2.2–4.7 cm; collective veins arising from 1st or 4th basal veins, 2–6 mm from the margins. INFLORESCENCE erect; *peduncle* 24.3–35.6 cm, 0.3–0.6 cm diam., greenish, 0.4–0.8× longer than the petiole; *spathe* subcoriaceous, green, persisting, hooding spadix, 8.6–9.3 × 2.3–2.6 cm, elliptic-lanceolate, acute at apex, obtuse at base, the margins meeting at ca. 170°; *spadix* cylindric, weakly tapered, 6.4–8.4 cm, 0.5–0.6 cm diam. near to base, 0.4–0.5 cm diam. near to apex, pale green; stipe 0.5–0.8 cm in front, ca. 0.2 cm in back. Flowers square, margins straight, ca. 2 × 2 mm; 6 to 10 flowers visible on the principal spiral, 5 to 6 flowers visible in the alternate spiral; tepals broadly convex in the inner margins; *pistils* with stigmas rounded; stamens protruding at anthesis; anthers surrounding the stigmas; thecae divaricate. INFRUCTESCENCE spreading; spadix ca. 14.8 cm, ca. 1.2 cm diam., dark green; *berries* ca. 0.4 cm.

Distribution and habitat. *Anthurium linganii* is known from the Departments of Huánuco and San Martín (Peru), ranging from 620 to 1100 m in elevation. This species grows in Tropical rain forest transition to Premontane (T-rf/P) and Tropical wet forest (T-wf) life zones.

IUCN Red List category. Conservation for *Anthurium linganii* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001) because it is known from six collections and has been found in both Huánuco and San Martín Departments, Peru.

Etymology. The species is named in honor of Jorge Lingán Chávez, second author of this paper, from Lima, Peru. Jorge is currently the only Peruvian working with the family Araceae and is working on his graduate degree at Texas Christian University in Fort Worth, Texas. He has worked with the first author at the Missouri Botanical Garden on several papers dealing with Araceae.

Discussion. *Anthurium linganii* is a member of *Anthurium* sect. *Belolonchium* Schott ex Engler and is distinguished by its narrowly ovate leaves that are bicolorous and darker adaxially, cataphylls persisting as reddish brown fibers with fragments of epidermis, and stipitate green spadix.

Paratypes. PERU. **Huánuco:** Leoncio Prado, Tingo María–Pucallpa, La Divisora, 3.8 km N of Ucayali frontier, 9°09′59″S, 75°47′32″W, 1072 m, 3 June 1998, *Croat & Sizemore 81692* (MO, USM); Tingo María on rd. past airport to Huayna Cápac, W of Tingo María airport, 8.7 km W of bridge over Río Huallaga at Tingo María, 9°12′S, 75°48′W, 1200 m, 5 June 1998, *Croat & Sizemore 81835* (MO, USM); Tingo María–Pucallpa, at La Divisora, 2.5 km W of Ucayali border, 9°09′59″S, 75°47′32″W, 1072 m, 3 June 1998; *Croat & Sizemore 81705* (MO, USM). **San Martín:** Tocache Nuevo–Juanjuí, valley of Río Huallaga, 63 km N of Tocache Nuevo, 117 km S of Juanjuí, 18.7 km S of Río Pulcache, 7°55′S, 76°40′W, 630 m, 8 Apr. 1984, *Croat 58058* (AAU, HUT, M, MO, P, S, SEL, UB, USM, VEN); Tingo María, Tingo María–Huánuco, 625–1100 m, 15 Jan. 1950, *Allard 21975* (US).

6. Anthurium longissimilobum Croat, sp. nov. TYPE: Peru. Huánuco: Prov. Leoncio Prado, Rupa Rupa, rd. to Jacintillo, W of Tingo María, 670 m, 28 Oct. 1971, *J. Schunke-Vigo 5087* (holotype, NY; isotypes, COL, F, MO, US). Figures 4B, C, 5A–C.

Planta epiphytica; internodia brevia, 1–2 cm diam.; cataphyllum intactum persistens; petiolus (16–)31–67.7 cm longus, (2)5–8 mm diam.; lamina anguste triangulari-subhastata, (22–)57.5–73.5 cm longa, (6.3–)11.5–25.2 cm lata, lobis posterioribus 6.2–14.9 cm longis, (2–)3.2–5.5 cm latis; pedunculus 65–76 cm longus; spatha 30.5–37.8 cm longa, 1.1–2.2 cm lata, ad basim usque ad ca. 9.5–10.8 cm decurrens; spadix pendens, 43.5–54.8 cm longa, ad apicem 6–8 mm diam., ad basim 6–10 mm diam.

Appressed-climbing epiphyte; stem less than 20 cm; *internodes* short, less than 1 cm, 1–2 cm diam., drying reddish brown; leaf scars ca. 1.2 × 1.3 cm, mostly obscured by persisting cataphylls; roots not seen; *cataphylls* bluntly 2-ribbed, coriaceous, (6.5–)8–23.5 cm, narrowly acute, drying pale reddish brown, persisting intact; *petioles* semi-erect, (16–)31–67.7 cm, (2–)5–8 mm diam., subterete, semi-rigid, matte, faintly striate, otherwise smooth, drying pale reddish brown, sheathed to (1–)3–4 cm; geniculum 1.5–2 cm, drying more distinctly reddish brown than petiole; *blades* narrowly triangular-subhastate, subcoriaceous, narrowly acuminate at apex, broadest at base, (22–)57.5–73.5 × (6.3–)11.5–25.2 cm, 2.9–5× longer than wide, subhastate with slender posterior lobes spreading at 155°, adaxial surface drying light olive-green, abaxial surface reddish brown; anterior lobe (4.5–)6–7 cm midway; posterior lobes 6.2–14.9 × (2–)3.2–5.5 cm, 1.9–3.2× longer than broad, rounded at apex, margins straight and revolute; sinus bullet-shaped, 6.2–14.9 cm deep; *midrib* prominently raised near base adaxially and diminishing toward apex, drying light brown, convex, drying light reddish brown abaxially; *basal veins* numerous, none free to base, coalesced; posterior rib (2.5–)11–14.5 cm, naked 1–4 cm; *primary lateral*

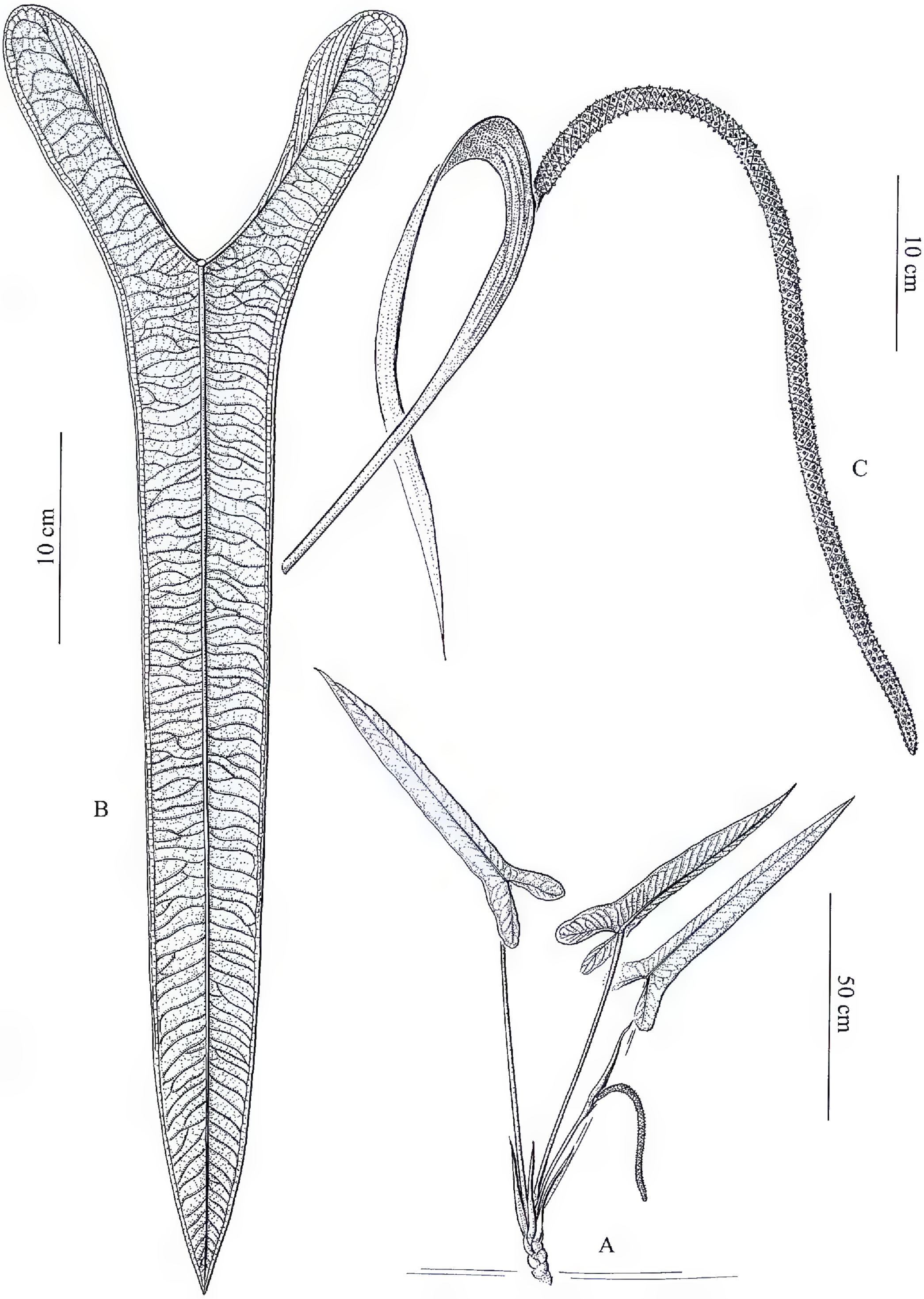

Figure 5. A–C. *Anthurium longissimilobum* Croat. —A. Habit. —B. Leaf (abaxial view). —C. Inflorescence. Drawn from *Schunke 5087* (MO, isotype) by John Myers.

veins numerous per side, generally spreading at 80°, usually sigmoid, arising at ca. 8°, forming an S-shaped curve, then merging on the upward swing with the margin, weakly raised and about as prominent as interprimary veins adaxially; interprimary veins ± equaling primary lateral veins; tertiary veins visible and weakly raised abaxially; collective veins moderately weak, arising from near the outer base of posterior lobes, slightly more prominent than primary lateral veins, (1–)3–8 mm from margin. INFLORESCENCE

with *peduncle* 65–76 cm, 4–6 mm diam., subterete, about as long as petiole, drying light reddish brown; *spathe* semi-erect at ca. 20°, curved gradually backward, 30.5–37.8 × 1.1–2.2 cm, ca. 1/2 as long as peduncle, inserted on peduncle at ca. 10°, conspicuously decurrent, subcoriaceous, bright yellow-green, forming a spiral, drying reddish brown, acuminate at apex, acumen spiraled and apiculate, narrowly acuminate and decurrent ca. 9.5–10.8 cm at base; *spadix* pendent, cylindrical but slightly tapered at apex, 43.5–54.8 cm, 6–8 mm diam. at apex, 6–10 mm diam. at base, ca. 78–87× longer than wide, stipitate 5–20 mm in back, drying dark reddish brown. Flowers ca. 3.2 × 3.3 mm, edges straight; 4 to 5 flowers visible on the principal spiral, 5 to 7 flowers visible on the alternate spiral; tepals drying dark brown, lateral tepals 1.5–1.9 mm, outer margins rounded to broadly rounded; *pistils* weakly exserted above tepals on drying, drying dark reddish brown; anthers ca. 0.4 × 0.8 mm; thecae broadly ovate to round when open. INFRUCTESCENCE erect; peduncle ca. 65 cm, ca. 6 mm diam.; spadix to 22 cm, ca. 1.5 cm diam.; tepals brown; *berries* dark violet-purple to yellow-green (sensu *Schunke 7289*).

Distribution and habitat. *Anthurium longissimilobum*, a member of *Anthurium* sect. *Calomystrium*, is endemic to the transitional zone between Premontane wet forest (P-wf) and Tropical moist forest (T-mf), at 670 to 1510 m elevation, in the area of Tingo María in Huánuco Province, Peru.

IUCN Red List category. Conservation for *Anthurium longissimilobum* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001) because it is known from four collections in three provinces.

Discussion. *Anthurium longissimilobum* is characterized by its narrowly triangular-subhastate blades with long, slender posterior lobes (hence the name "longissimilobum"), with all the primary lateral veins and the branches from the posterior rib with the veins forming an unusual sigmoid shape. Also characteristic is the conspicuously decurrent spathe.

Paratypes. PERU. **Amazonas:** Bagua, along trail ca. 5 km above La Peca, 15.6 km E of main plaza in Bagua, 5°33′S, 78°21′W, 1050–1160 m, 16 Apr. 1984, *Croat 58354* (MO). **Huánuco:** Tingo María–Pucallpa, 15° WNW, 1510 m, 5 Jan. 1971, *Ellenberg 3861* (MO). **San Martín:** Mariscal Cáceres, Uchiza, Cachiyacu de Lopuna, 450–500 m, 10 July 1974, *Schunke-Vigo 7289* (MO).

7. **Anthurium pradoense** Croat, sp. nov. TYPE: Peru. Huánuco: on 60° angle rocky slope above Río Huallaga, at Tingo María, 4 Oct. 1972, *T. B. Croat 21079* (holotype, MO-3432683; isotypes, B, COL, F, K, NY, US, USM). Figure 6A, B.

Planta terrestris vel epipetrica; internodia brevia, 1.5–4 cm diam.; cataphylla usque ad 8.5 cm longa, petiolus (20–)47–89.3 cm longus; lamina profunde 7- ad 9-pedatisecta, 24–27 cm longa, 17.5–50.4 cm lata, nervis primariis lateralibus utrinque 10 ad 13; pedunculus 65–74 cm longus; spatha lanceolata, 8–12.7 cm longa, 10–12 mm lata; spadix 12–15 cm longa, 5–7 mm diam., purpurascens.

Terrestrial or epipetric; roots descending, 3 mm diam., drying grayish brown; stem less than 20 cm; *internodes* short, 1.5–4 cm diam.; *cataphylls* to 8.5 cm, persisting semi-intact at first, eventually deciduous persisting as a few pale brown fibers. LEAVES relatively few per plant, erect; *petioles* (20–)47–89.3 cm, drying (0.2–)0.5–0.8 cm diam. midway, subterete, obtusely and narrowly sulcate, dark green to medium green, matte to semiglossy; geniculum 1–2.8 cm; *blades* 24–27 × 17.5–50.4 cm, deeply pedatisect, fused (0.2–)1.6–10.5 cm at base, broadly ovate, about as broad as long, subcoriaceous, dark green and semiglossy adaxially, slightly paler and matte to weakly glossy abaxially; sinus 1.6–3.2 cm deep, broadly V-shaped; segments 7 to 9, narrowly acuminate, acumen very slender, 1.5–2.5 cm; medial segments (22–)30–47 × 7–10 cm; outermost segments markedly falcate, (14.7–)24–27 cm; *midrib* convex to narrowly raised and concolorous adaxially, narrowly raised and paler abaxially; *primary lateral veins* 10 to 13 pairs per side, arising at 50°–60°, joining collective veins 2–8 mm from margin, paler than surface adaxially, weakly sunken adaxially, weakly raised abaxially; collective veins arising from lowermost primary lateral veins, moderately obscure adaxially, weakly raised abaxially. INFLORESCENCE erect-spreading; *peduncle* 65–74 cm, 5–6 mm diam.; *spathe* lanceolate, green, 8–12.7 cm × 10–12 mm, spreading-reflexed, narrowly acuminate, affixed at ca. 45° angle; *spadix* 12–15 cm, 5–7 mm diam., purplish becoming brownish green post-anthesis. INFRUCTESCENCE erect; spadix 6.5 cm; *berries* dark wine-red to purplish violet, subglobose, ca. 5 mm diam.

Distribution and habitat. *Anthurium pradoense* is endemic to the vicinity of Tingo María in the Río Huallaga valley at 650 to 700 m elevation. The species is found growing on steep, rocky banks and cliffs in shady, damp areas in the Tropical rain forest transition to Premontane (T-rf/P).

IUCN Red List category. Conservation for *Anthurium pradoense* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001) because, although the species is known from only five collections from a single area, the plants are locally common and the species occurs in the Cueva de las Lechuzas reserve near Tingo María.

Figure 6. A, B. *Anthurium pradoense* Croat (*Croat & Sizemore 81616*). —A. Habit. —B. Leaf (abaxial surface). Note the leaflets are not free to the base. C, D. *Anthurium pulcachense* Croat (*Plowman & Schunke 11633*, cultivated at Selby Gardens). Photos by Vern Sawyer. —C. Habit. —D. Inflorescence.

Etymology. The specific epithet derives from the provincial name where *Anthurium pradoense* occurs, Leoncio Prado.

Discussion. *Anthurium pradoense* belongs to *Anthurium* sect. *Schizoplacium* Engler and is most often confused with *A. longissimum* Pittier from the Cordillera Coastal of northern Venezuela. It shares with that species many features including blade shape, a long peduncle, and purplish spadix, but *A. pradoense* differs in having smaller blades that are usually more deeply lobed, thinner in texture, and matte on both surfaces (vs. obviously semiglossy blades in *A. longissimum*). In addition, the petioles of *A. longissimum* are more deeply sulcate, and plants are typically appressed-climbing epiphytes rather than terrestrial or epipetric plants.

Paratypes. PERU. **Huánuco:** Prov. Leoncio Prado, Jacintillo on Río Monzón, W of Tingo María, 700 m, 12 Apr. 1976, *Plowman 5890* (GB, MO, USM); Tingo María–Monzón, Río Patay Rondos, ca. 6 km from Tingo María, 9°20′S, 76°08′W, 650 m, 4 Apr. 1984, *Croat 57919* (MO, USM); valley of Río Huallaga, along steep banks of Río Monzón, near bridge over Río Patay Rondos, Tingo María–Monzón, 9°17′S, 76°05′W, 650 m, 2 June 1998, *Croat & Sizemore 81616* (MO, USM); cultivated material at Museo de Historia Natural, collected 2 June 1978, live plant originally collected at Tingo María, *Ferreyra 19013* (USM).

8. Anthurium puberulum Croat & Lingán, sp. nov. TYPE: Peru. Huánuco: Prov. Leoncio Prado, Tingo María–Pucallpa, at La Divisora, 2.5 km W of Ucayali border, 9°09′59″S, 75°47′32″W, 1072 m, 3 June 1998, *T. B. Croat & M. Sizemore 81704* (holotype, MO-4951761; isotypes, AAU, B, COL, HUT, K, NY, QCNE, SEL, UB, US, USM). Figures 4D, 8A, B.

Terrestris vel hemiepiphytica; internodia (3.2–)5–10 cm longa, 0.7–0.9 cm diam.; cataphylla 7.4–11.1 cm longa, decidua; petiolus 15.5–27.7 cm longus, 0.1–0.3 cm latus, in litteram D formatus; lamina 11.9–32.4 cm longa, 7.2–18.1 cm lata, sagittata vel sagittato-hastata, ad basim profunde cordata; nervis primariis lateralibus utrinque 5 ad 8; pedunculus 20.1–39.3 cm longus, 0.2–0.3 cm diam.; spatha viridis; spadix purpurea, sub anthesi 5.7–8.2 cm longa, 0.4–0.5 cm diam.

Description based on dried material. Terrestrial to hemiepiphytic, occasionally epiphytic; *internodes* (3.2–)5–10 cm, 0.7–0.9 cm diam., weakly glossy, grayish green; *cataphylls* oblong-lanceolate, bluntly 1-ribbed, obtuse to broadly acute at apex, 7.4–11.1 cm, membranaceous, deciduous, yellowish brown. LEAVES spreading; *petioles* 15.5–27.7 × 0.1–0.3 cm, sharply D-shaped with acute margins, matte, undulate on geniculum, green; sheath 1.7–

4.7 cm; geniculum 0.8–2 cm; *blades* thinly coriaceous, 11.9–32.4 × 7.2–18.1 cm, broadest at the base, prominently lobed, sagittate to sagittate-hastate, acuminate at apex, dark green and weakly glossy adaxially, moderately paler and matte abaxially, conspicuously bullate, drying green to brownish green; margins convex, sometimes concave; posterior lobes elliptic, rarely oblong, divergent, 3.5–6.9 cm; sinus widely hippocrepiform, rarely narrowly spatulate, all major and minor veins granular-puberulent; *midrib* acutely raised in valley adaxially, conspicuously round-raised abaxially; *primary lateral veins* 5 to 8 pairs per side, straight, sunken adaxially, conspicuously raised abaxially, departing midrib at 30°–50°; interprimary veins sunken adaxially, raised abaxially; lesser veins raised in both faces, more conspicuously abaxially, areoles granular; basal veins 4 to 6 pairs, 1st and sometimes 2nd free to the base, fused 3rd to 6th to the basal ribs; posterior ribs 2.4–4.6 cm, retrorse, naked 1.2–2.4 cm; collective veins arising from the 1st basal veins, rarely from the 2nd, 0.6–1.4 cm from the margins, sunken adaxially, conspicuously raised abaxially. INFLORESCENCE erect; *peduncle* 20.1–39.3 cm, 0.2–0.3 cm diam., green, 1.2–1.4× longer than the petiole; *spathe* subcoriaceous, green, reflexed, deciduous after anthesis; *spadix* pale green at pre-anthesis, purple at anthesis, becoming green at post-anthesis, tapered, 5.7–8.2 cm, 0.4–0.5 cm diam. at base, ca. 0.2 cm diam. at apex, shortly stipitate, ca. 0.1 cm. Flowers square to slightly rhombic, margins weakly sigmoid, ca. 3 × 2 mm; 5 flowers visible on the principal spiral, 6 to 7 flowers visible on the alternate spiral; tepals with the inner margins convex; *pistils* with stigmas rounded, never exserted; stamens exserted with filaments and anthers protruding at anthesis, filaments flattened; thecae slightly divaricate. INFRUCTESCENCE not seen.

Distribution and habitat. *Anthurium puberulum* is known from the Cordillera Azul at La Divisora (Huánuco Department, Peru), a range of hills near Tingo María, from 1072 to 1737 m elevation in Tropical rain forest transition to Premontane (T-rf/P) and Tropical wet forest transition to Premontane (T-wf/P).

IUCN Red List category. Conservation for *Anthurium puberulum* must be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001). Although the species is known from four collections, all in the Cordillera Azul, there is no way to know how common the species is there, and there remains a need for investigation against future conservation efforts. The region of La Divisora is steep and has many endemic species. It might well qualify for protected status.

Discussion. This species belongs to *Anthurium* sect. *Xialophyllium* and is distinguished by its conspicuously bullate leaves with puberulent veins on the abaxial blade surface (hence the name "puberulum"), long internodes, green spathe, and purplish spadix. The species probably closest resembles *A. crassivenium* Engler, a species that also has a conspicuously bullate leaf blade with a purplish spadix, but that species has a narrowly ovate-cordate leaf blade that is not at all constricted above the blade base.

Paratypes. **Huánuco:** Cordillera Azul, ca. 42.7 km E of Tingo María on rd. to Pucallpa, 1722 m, 21 Nov. 1979, *Davidson & J. Jones 9368* (LAM, MO); very near border of Dpto. Loreto, on rte. 16, 38 km N of Tingo María, Cordillera Azul, 1737 m, 10 Nov. 1975, *Davidson 3459* (LAM, MO); Leoncio Prado, Hermilio Valdizán, La Divisora, 21.8 km E of Puente Pumahuasi (Río Tulumayo), Tingo María–Pucallpa, 9°05′S, 75°52′W, 1550 m, 27 Dec. 1981, *Plowman & Schunke 11764A* (F, MO).

9. Anthurium pulcachense Croat, sp. nov. TYPE: Peru. San Martín: Tocache Nuevo–Juanjuí, valley of Río Huallaga, 63 km N of Tocache Nuevo, 117 km S of Juanjuí, 18.7 km S of Río Pulcache, 7°55′S, 76°40′W, 630 m, *T. B. Croat 58062* (holotype, MO-3189260; isotypes, AAU, B, CAS, COL, F, GH, K, LPB, MEXU, NY, RSA, TEX, US, USM, VEN). Figures 6C, D, 7A–D.

Planta terrestris; caudex brevis; internodia brevia, 1–2 cm longa; cataphylla 6–8.5 cm longa, intacta persistentia; petiolus 22–42.6 cm longus, triangulari-alatus; lamina cordata vel subcordata, (13–)30.4–41 cm longa, (9–)12.5–22 cm lata; inflorescentia erecta; pedunculus 25–40.7 cm longus, quadrangularis; spatha viridis, 4–18 cm longa, 1–4 cm lata; spadix atroviridis, 3–17.4 cm longa, ad apicem 2–3 mm diam., ad basim 3–7 mm diam.; fructus viridis.

Terrestrial; stem erect, less than 20 cm, drying dark brown; *internodes* short, 1–2 cm; roots dense, moderately short, densely covered with a layer of grayish root hairs; *cataphylls* 6–8.5 cm, deep rose-pink, drying light reddish brown, most persisting intact. LEAVES erect-spreading; *petioles* 22–42.6 cm, drying 3–10 mm diam., sharply triangular-winged, flattened adaxially, weakly sulcate medially, the winged margins downturned slightly, dark to medium green, matte, minutely speckled, drying light yellowish green; geniculum shaped like and slightly paler than rest of petiole, 1.5–3.3 cm; *blades* narrowly ovate, cordate to subcordate, coriaceous but softly textured, acuminate at apex, (13–)30.4–41 × (9–)12.5–22 cm, 1.4–2.5× longer than wide, 1/2 as long to as long as petiole, broadest near base; adaxially dark green and subvelvety, drying medium green; abaxially much paler and matte, drying light yellowish green; anterior lobe 13–34 cm; posterior lobe 0.7–4.7 × 5.5–21 cm,

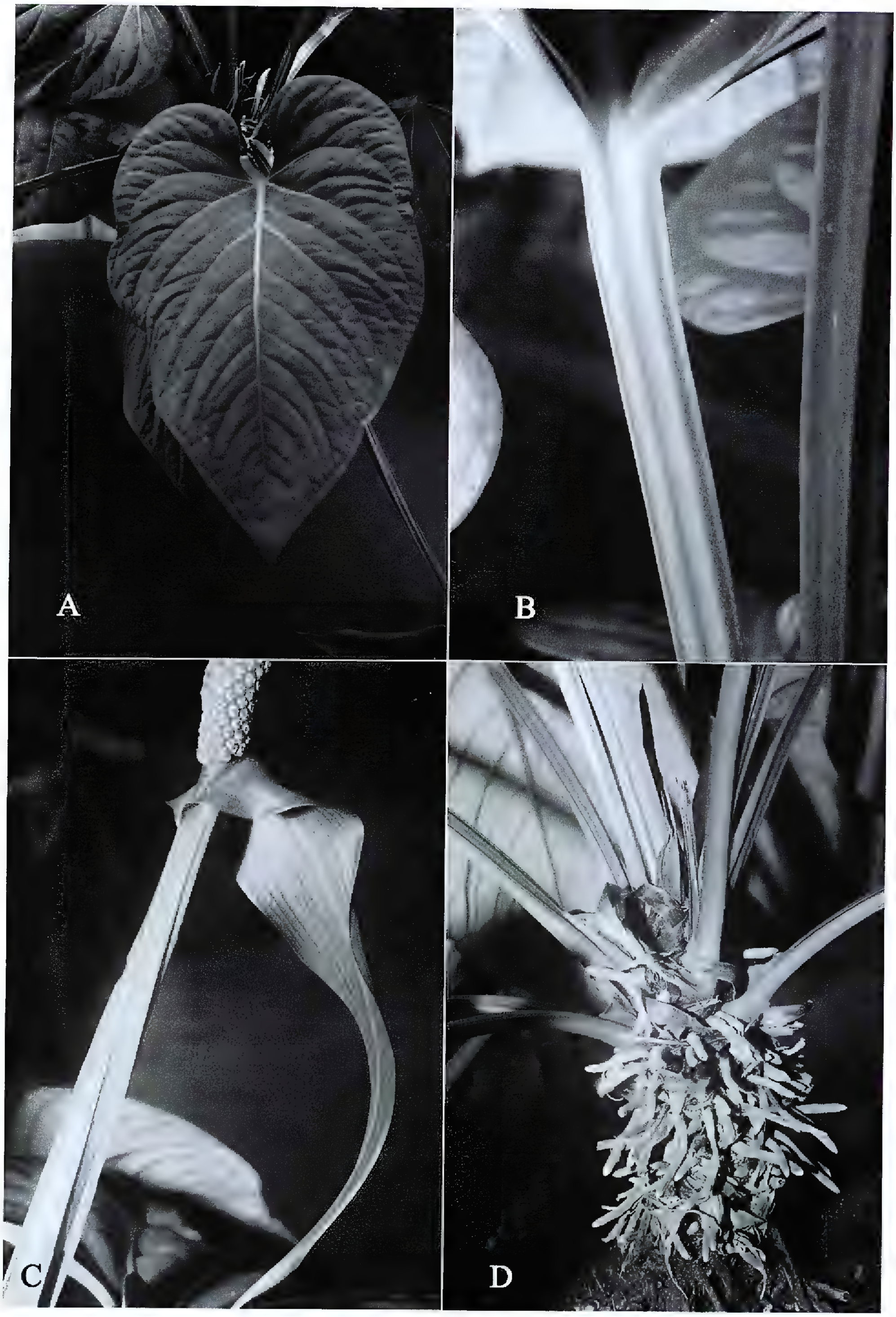

Figure 7. A–D. *Anthurium pulcachense* Croat (*Plowman & Schunke 11633*). —A. Leaf (adaxial view). —B. Petiole, close up. —C. Inflorescence showing the conspicuously ribbed peduncle. —D. Cataphylls. A cultivated at Selby Gardens; photo by Vern Sawyer; B–D cultivated at the Missouri Botanical Garden.

rounded at apex, sinus hippocrepiform to arcuate, 0.6–5 cm deep; *midrib* bluntly to sharply raised adaxially, more acute and thicker abaxially with a slender medial rib; *primary lateral veins* 6 to 12 pairs per side, arising at an acute angle then spreading at 40°–50°, then curved upward to the collective veins, bluntly raised and slightly paler, sometimes in valleys adaxially (decreasingly less raised toward apex), more

Figure 8. A, B. *Anthurium puberulum* Croat & Lingán (from the type collection *Croat & Sizemore 81704*, MO). —A. Leaf (adaxial view) and inflorescence. —B. Leaf (abaxial view). Note the conspicuously raised veins on the surface. C, D. *Anthurium timplowmanii* Croat (*Plowman 5873*). —C. Leaf adaxial surface. —D. Immature infructescence. C, D cultivated at Selby Gardens.

prominently raised and paler (sometimes darker) than surface abaxially, drying sharply raised; tertiary veins mostly obscure; collective vein arising from first basal vein, not as prominent as primary lateral veins, (1–)3–7 mm from margin. INFLORESCENCE erect; *peduncle* 25–40.7 × 0.4–0.8 cm, ca. as long as petiole, quadrangular-winged in cross section (one or more sides with a medial rib), dark greenish brown and

glistening; *spathe* reflexed to erect-spreading, lanceolate, green, 4–18 × 1–4 cm, subcoriaceous, inserted on peduncle at ca. 25°–30°; peduncle 2.2–6.3× longer than spathe; stipe 0.4–2.3 cm in front, 0.2–0.4 cm in back; *spadix* erect, held at ca. 10°–15°, 3–17.4 cm, 2–3 mm diam. at apex, 3–7 mm diam. at base, dark green, matte, drying brown. Flowers 6 to 7 visible in principal spiral, 3 to 5 flowers visible in alternate spiral, 2.6–2.8 × 1.6–2.6 mm; tepals matte; lateral tepals 1.6–2.6 mm, subtriangular, inner margins rounded, outer margins 2-sided; stamens closely clustered and held at surface of tepals, usually not contiguous, stamens held at surface of tepals; lateral stamens preceeding alternates by 7 spirals; anterior stamens preceding posterior by 4 spirals; anthers ca. 1.5 × 1 mm, drying ca. 0.24 × 0.4 mm; thecae ovoid-elliptic, moderately divaricate; *pistils* weakly exserted above tepals, purplish. INFRUCTESCENCE erect; *berries* green, ovoid, 6–7 mm.

Distribution and habitat. *Anthurium pulcachense* is endemic to Peru, known only from the Department of San Martín, Province of Mariscal Cáceres at 630 to 950 m elevation, near Pulcache (hence the name "pulcachense") in Premontane wet forest (P-wf).

IUCN Red List category. Conservation for *Anthurium pulcachense* must be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001) because the species is known only from a single introduction from the type locality. The species therefore remains in need of further investigation against future conservation efforts.

Discussion. *Anthurium pulcachense* is a member of *Anthurium* sect. *Cardiolonchium*, with unusual cataphylls persisting intact. It is recognized by its terrestrial habit; short, thick internodes; usually persistent cataphylls; triangular-winged petioles that are equal or longer than the blades; narrowly ovate, weakly cordate blades; erect inflorescences with a quadrangular petiole, lanceolate green spathe, and green, slightly tapered spadix; and green fruits.

Paratypes. PERU. **San Martín:** Mariscal Cáceres, Campanilla, Carretera Marginal de la Selva, 7.4 km N of Pulcache, ca. 7°43′S, 76°40′W, 900–950 m, 21 Dec. 1981, *Plowman & Schunke 11633* (F, MO, USM); *Plowman & Schunke 11633* cultivated at Selby Gardens, *Croat 78327* (MO), *Ingram & Atwood 984* (SEL).

10. Anthurium timplowmanii Croat, sp. nov. TYPE: Peru. Huánuco: Prov. Leoncio Prado, Distr. Rupa Rupa, vic. of Tingo María, Río Patay Rondos, Cuevas de Gucharo Parque Nacional de Tingo María, 9°21′S, 76°12′W, 650 m, 4 Apr. 1984, *Croat 57920* (holotype, MO-3186963; isotypes, B, COL, CUZ, F, K, M, NY, RSA, SEL, US, VEN). Figures 8C, D, 9A, B, 10.

Planta erecta; internodia brevia, 8–10 mm diam.; cataphylla in fibris persistentia; petiolus erectus, 9.2–32.8 cm longus, (1–)3–5 mm diam., teres; lamina anguste ovata, (7.5–)14.5–29.5 cm longa, (3–)6.3–11.5 cm lata, ad basim subcordulata, lobis posterioribus superpositis; nervis primariis lateralibus utrinque 23 ad 27; pedunculus 5.7–27.5 cm longus; spatha 3–7.5 cm longa, 4–10 mm lata, lanceolata, viridis; spadix 2.7–7.1 cm longa, 2–3 mm lata.

Epiphyte to lithophyte; stem short, 8–10 cm; *internodes* 3–5 mm, 8–10 mm diam.; *cataphylls* ca. 2 cm, persisting as pale brown to brown fibers; *petioles* erect, 9.2–32.8 cm, (1–)3–5 mm diam., terete, rigid, drying light olive-green, striate; geniculum 1–2 cm; *blades* narrowly ovate, (7.5–)14.5–29.5 × (3–)6.3–11.5 cm, 2.4–2.6× longer than wide, 0.6–1.1× as long as petiole, broadest near base, narrowly acuminate at apex, acumen 1.8–3 cm, subcordate at base, the lobes overlapping, drying subcoriaceous; both surfaces semiglossy when fresh; adaxial surface light olive-green, drying matte; abaxial surface dark olive-green, drying semiglossy; margins entire and semicrisped; anterior lobe (7.3–)13–27 cm; posterior lobes 0.2–3 cm, up to 5.4 cm wide, rounded at apex; *midrib* drying slightly raised, diminishing toward apex adaxially and abaxially, drying light yellowish green adaxially, drying light yellow abaxially; *basal veins* 3 pairs, all free to base, drying inconspicuous; *primary lateral veins* numerous, 23 to 27 pairs per side, not obvious when fresh, weakly raised adaxially, flat and obscure, much paler, prominulous on drying abaxially, arising from midrib at ca. 90° midway, spreading almost straight or weakly arcuate to the margin, to ca. 45° toward apex, and ca. 45° toward the base, but soon reflexed and forming a broad sigmoid curve toward the margin; interprimary veins less prominent than primary lateral veins; collective vein arising from the 2nd basal vein, as prominent as primary lateral veins, 2–7 mm from margin. INFLORESCENCE mature, erect; *peduncle* erect, 5.7–27.5 cm, drying 1–2 mm diam., terete, ca. 1/2 as long as petiole, drying light yellowish green; *spathe* erect-spreading, inserted at ca. 70°, 3–7.5 cm × 4–10 mm, lanceolate, subcoriaceous, green, drying light yellowish brown, narrowly long-acuminate at apex, acumen 7–8 mm long, acute at base, the margins meeting at ca. 60° angle, 4/5 to as long as spadix; stipe 4–6 mm long in front, 1–1.6 mm in back; *spadix* erect, subcylindric, 2.7–7.1 cm, 2–3 mm diam. at apex, 2.5–3 mm diam. at base, 13–24× longer than wide, yellowish green to blue-green or brown, drying light yellowish brown, held at ca. 180°. Flowers square to rhombic, 1.8–2.1 × 1.9–2.5 mm, drying light brown, 5 to 6 flowers

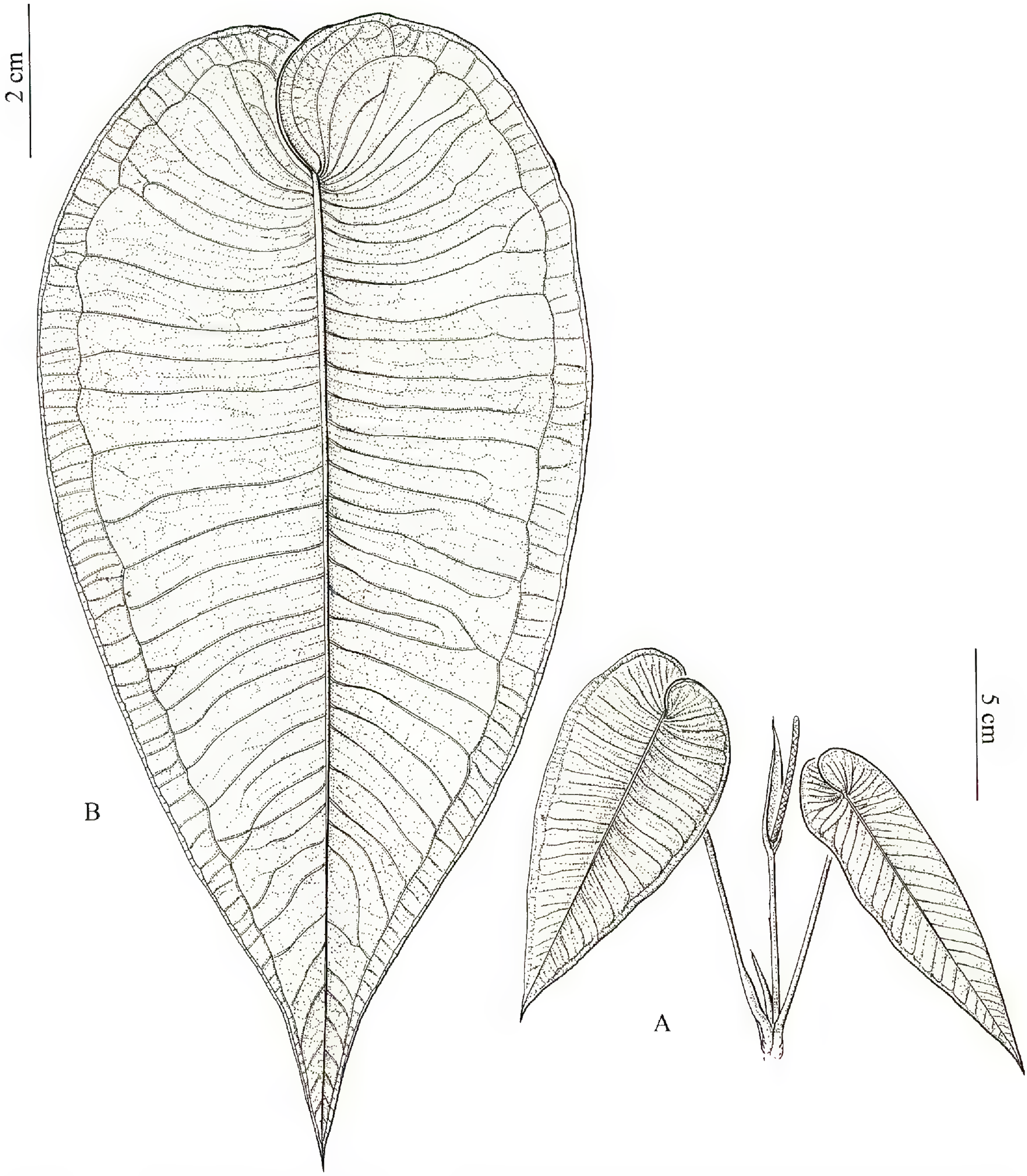

Figure 9. A, B. *Anthurium timplowmanii* Croat. —A. Habit. —B. Leaf (adaxial surface). Drawn from *Plowman 5747B* (SEL) by John Myers.

visible in the principal spiral, 3 to 4 flowers visible in the alternate spiral; tepals matte, almost erect against pistil on drying, lateral tepals outer margins broadly triangular, inner margins broadly rounded, sometimes drying concave; *pistils* drying paler; stigma slit-like, drying pale. INFRUCTESCENCE not seen.

Distribution and habitat. *Anthurium timplowmanii* is endemic to Peru, known only from the type locality in the Department of Huánuco, Province of Leoncio Prado, in Premontane wet forest (P-wf), at 650 to 900 m elevation.

IUCN Red List category. Conservation for *Anthurium timplowmanii* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), owing to the fact that the species has been collected four times in several localities in the region of Tingo María.

Etymology. The new species is named for the late Tim Plowman of the Field Museum, who made the first

Figure 10. *Anthurium timplowmanii* Croat (*Plowman 5873*, MO). Habit in cultivation at the Missouri Botanical Garden.

collection of the species in 1976 and who made a subsequent collection in 1979. Dr. Plowman was one of the principal collectors of important living collections during his career and collected many new and interesting Araceae.

Discussion. *Anthurium timplowmanii* is a member of *Anthurium* sect. *Cardiolonchium* and is characterized by its narrowly ovate, subcordate blades with overlapping posterior lobes and especially by its many primary lateral veins and its bluish green, subcylindric spadix and green lanceolate spathe.

Paratypes. PERU. **Huánuco:** Leoncio Prado, Río Monzón, Cueva de las Lechuzas, 700–800 m, 27 June 1979, *Plowman 5747B* (GH, SEL); Rupa Rupa, Calpar Bella, Cueva de los Hauriños, Río Monzón, 700–900 m, *Schunke 9487A* (MO); valley of Río Huallaga, along steep banks of Río Monzón near bridge over Río Patay Rondos, Tingo María–Monzón, 9°17′S, 76°05′W, 650 m, 2 June 1998, *Croat & Sizemore 81611* (MO, USM); near Bellam hills to the W of Cueva de las Lechuzas, 700–850 m, 11 Apr. 1976, *Plowman 5873* (GH, MO, SEL, USM); *Plowman 5747* cultivated at Selby Gardens, *Madison 5502* (SEL 69–1976–2).

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Additions to *Gladiolus* (Iridaceae) in the Flora Zambesiaca Region: The New Species *G. metallicola* and the Reinstatement of *G. mosambicensis*

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ABSTRACT. New fruiting collections made since the publication of an account of Iridaceae for *Flora Zambesiaca* in 1993 show that spring-flowering plants until now referred to *Gladiolus crassifolius* Baker are better treated as a separate species, the earliest name for which is *G. mosambicensis* Baker. It is distinguished by the slightly smaller flowers, dry, obtuse floral bracts, and round, broadly winged seeds; *G. crassifolius* has green, acute bracts and wedge- to pear-shaped seeds with the wing fully developed at one or both ends but not on the sides. In addition, plants from northern Zimbabwe provisionally referred to *G. permeabilis* subsp. *edulis* (Burchell ex Ker Gawler) Obermeyer in the *Flora Zambesiaca* account of the genus do not belong in this species and are here described as *G. metallicola* Goldblatt. This plant, a member of section *Hebea* (Persoon) Bentham & Hooker f., remains known from one collection from the Great Dyke in Lomagundi District. *Gladiolus* L., the largest genus of the Iridaceae in the flora, now has 39 species in the Flora Zambesiaca region alone, and a total of 254 species worldwide.

Key words: *Gladiolus*, Iridaceae, IUCN Red List, Mozambique, Zimbabwe.

One of the two largest genera of the Iridaceae, *Gladiolus* L. comprises over 250 species, mostly of sub-Saharan Africa, but with some 10 species in Europe and the Middle East. The center of the genus is southern Africa where 165 species occur, but over 80 species are recorded in tropical Africa. Of these, 37 species were recorded in the countries that make up the Flora Zambesiaca region: Botswana, Malawi, Mozambique, Zambia, and Zimbabwe. In my accounts of the genus in *Flora Zambesiaca* and for all of tropical Africa (Goldblatt, 1993, 1996), *G. crassifolius* Baker was broadly circumscribed to include early spring-blooming plants of eastern Zimbabwe and adjacent interior Mozambique, as well as those that flower in the late summer and autumn and that occur over the entire range of the species, from eastern South Africa to Tanzania. New collections that have come to hand make it clear that the spring-blooming plants referred to *G. crassifolius* have different seeds, and this combined with their slightly smaller flowers, obtuse, dry floral bracts, shorter stature, and often emergent leaves at flowering time indicates that they are better treated as a separate species. Two names are available in the literature for the species, the earlier one being *G. mosambicensis* Baker. I provide a formal description below and detail its difference from *G. crassifolius*.

A second species of *Gladiolus*, known from just one gathering in northern Zimbabwe, was provisionally referred to as *G. permeabilis* subsp. *edulis* (Burchell ex Ker Gawler) Obermeyer, with a brief note listing its differences from that species. No additional collections of this plant have been made, but it has become clear that it represents a novelty. I had hoped to recollect the species and study living plants, but this eventuality is now unlikely. I describe the species here as *G. metallicola* Goldblatt.

1. **Gladiolus metallicola** Goldblatt, sp. nov. TYPE: Zimbabwe. Mashonaland West: Lomagundi District, Great Dyke, among rocks on summit ridge, 8 Apr. 1981, *D. Philcox & T. Muller 9079* (holotype, K; isotype, SRGH).

Haec species *Gladiolo permeabili* D. Delaroche primo aspectu similis, sed foliis marginibus costisque incrassatis, floribus minoribus, tubo perianthii ca. 10 mm longo, tepalo dorsali ca. 16 mm longo, apicibus attenuatis nullis, antheris ca. 4–5 mm longis et stylo brevi infra apices filamentorum diviso.

Geophyte 45–50 cm tall; *corm* probably globose, ca. 15 mm in diam., tunics of dark brown, fairly fine, netted fibers; *stem* branched, enclosed by leaf sheaths to the base of the spike. *Leaves* 5 or 6, the lower 2 with well-developed sublinear blades about as long as the stem, 2–6 mm wide in the middle, the margins and central vein heavily thickened and 2 or 3 secondary veins present between them, hyaline when dry, upper 3 or 4 leaves largely to entirely sheathing, the sheaths with membranous or dry, light brown margins. *Spike* secund, with 10 to 15 flowers, slightly flexuose; bracts

soft-textured, pale green, becoming dry and light brown in the upper half, the outer ovate, (9–)10–12 mm, the inner 1–2 mm shorter, rounded apically or notched at the tip. *Flowers* pale blue-lilac, the tepals marked dark red in the midline; *perianth tube* obliquely funnel-shaped, ca. 10 mm; tepals unequal, the dorsal largest, ca. 16 mm long, widest in the upper third, narrowed and claw-like in the lower third, arching forward over the stamens and style, upper lateral and lower tepals joined together for 2–3 mm forming a lower lip, ca. 10 mm, tapering below to a narrow grooved claw ca. 3 mm; *filaments* arching beneath the dorsal tepal, ca. 10 mm; anthers 4–5 mm, evidently purple; *ovary* ovoid, ca. 3 mm; style arching over the filaments, dividing between the base and middle of the anthers, the branches spreading, ca. 2 mm. *Capsules* and *seeds* unknown.

Distribution, habitat, phenology, and etymology. *Gladiolus metallicola* is named for the heavy-metal-enriched soils and rocks of the Great Dyke of Zimbabwe. We assume the species is an endemic of these specialized soils, which would explain its rarity in a relatively well-collected country like Zimbabwe. Plants flower fairly late in the season, in April, and probably, given the advanced state of flowering in the type collection, also in March.

IUCN Red List category. Conservation status of *Gladiolus metallicola* is uncertain as the species is known from a single gathering. This, combined with its specialized habitat in a country relatively well known botanically, makes it clear this is a rare species. I suggest Near Threatened (NT) status, following the IUCN Red List conservation categories (IUCN, 2001). The extremely narrow range and occurrence on mineral-enriched soils, likely at some future date to be the focus of mining activities, prompt this decision, but I have no personal experience of this plant in the field.

Discussion. In general aspect, *Gladiolus metallicola* most closely resembles the southern African *G. permeabilis* and, in particular, subspecies *edulis*. This species, the most widespread member of section *Hebea* (Persoon) Bentham & Hooker f. of *Gladiolus* (Goldblatt, 1996), extends from the southern tip of South Africa to Namibia and Zimbabwe, with subspecies *edulis* extending across summer-rainfall southern Africa and subspecies *permeabilis* restricted to the winter-rainfall zone in the southwest of the subcontinent (Goldblatt & Manning, 1998). The narrow, whip-like leaf blades are a distinctive feature of *G. permeabilis* and other members of the informal series Permeabilis (Goldblatt & Manning, 1998). The central vein and the central portion of the linear leaves are thickened, whereas the margins are usually barely raised and secondary veins are not evident. In general, the leaf margins of most species of series Permeabilis are not thickened. Leaves of *G. metallicola*, with their thickened margins and central veins (they are hyaline and conspicuous when dry), thus stand out in section *Hebea*. The other distinctive feature of section *Hebea* are the tepals, which are typically narrowed into claws below, such that in profile one can see through the resulting gap between the narrowed tepals. *Gladiolus metallicola* has basally narrowed tepals and appears to conform to this windowed condition. Other identifying features of section *Hebea* reside in the corm tunics, capsules, and seeds, lacking in the one collection of *G. metallicola*.

The general similarity in appearance of *Gladiolus metallicola* to *G. permeabilis* subsp. *edulis* is, in fact, superficial, for not only do the leaves differ markedly in their prominently thickened margins, but the flowers are smaller and lack the tapering attenuate tips of the tepals. Flowers of *G. permeabilis* subsp. *edulis* are cream, flushed purple outside, relatively large, with the dorsal tepal 28–35 mm long and anthers 6.5–9 mm long. This is substantially larger than in *G. metallicola*, which has a dorsal tepal ca. 16 mm long and anthers 4–5 mm long. An odd feature of *G. metallicola* is the short style that divides between the base and middle of the anthers, whereas in most *Gladiolus* species the style reaches the tips of the anthers. Additional collections of the species are needed to confirm the features recorded here and to substantiate my decision to treat the collection as a new species of section *Hebea*, and to confirm that the corm tunics and capsules conform to the section.

2. Gladiolus mosambicensis Baker, Fl. Trop. Afr. 7: 576. 1898. TYPE: Mozambique. [Sofala Province:] "Beira," s.d., *A. J. Braga 117* (holotype, B).

Gladiolus gazensis Rendle, J. Linn. Soc., Bot. 40: 210. 1911. TYPE: Zimbabwe. Chimanimani (Melsetter), 1800 m, 23 Sep. 1907, *Swynnerton 779* (lectotype, designated by Goldblatt, 1993: 70, BM; isotype, K).

Plants 30–40 cm tall, sometimes with multiple stems; *corm* 18–30 mm in diam., tunics coarsely fibrous; *stem* sometimes simple, or up to 5-branched. *Leaves* evidently 3 or up to 5, dry at flowering time, often scorched by fire, or new leaves emerging; blades narrowly sword-shaped, as long or longer than the spike, 2–6 mm wide, the margins and central veins heavily thickened. *Spike* with 10 to 15 flowers, branches with fewer; bracts (9–)12.5–15 mm, ca. half

the length of one internode, evidently partly dry at flowering, subacute, obtuse, or obtuse-apiculate; inner bracts slightly shorter, usually obtuse, sometimes emarginate. *Flowers* pale to deep pink or light purple, the lower lateral and sometimes the lowermost tepal each with a dark band of color across the lower half of the limb, presence of scent unknown; *perianth tube* obliquely funnel-shaped, cylindric below, widening and curving outward in upper half, 8–9 mm; *tepals* unequal, the dorsal largest, broadly ovate, arching over the stamens and style, 16–18 × 7–8 mm, the upper laterals directed forward and curving outward above, the lower 3 tepals ± straight and directed downward, united below for ca. 4 mm, narrowed into claws below, the lower laterals 10–13 × ca. 5 mm, the lower median 8–10 × ca. 4 mm; *filaments* ca. 10 mm, exserted 6–7 mm from tube; *anthers* 6–8 mm, evidently white to yellow; *style* arching over the filaments, usually dividing between the base and lower third of the anthers, the style branches 2.5 mm. *Capsules* obovoid, 12–16 mm, 3-lobed above and retuse; *seeds* ovate, broadly winged, 5–7 × 4–5 mm, the wing translucent or flushed light brown.

Discussion. One of the most widespread species of *Gladiolus*, *G. crassifolius* extends from southwestern Tanzania through Malawi, eastern Zimbabwe, and interior Mozambique to Eastern Cape Province of South Africa (Goldblatt & Manning, 1998). As currently circumscribed, the species includes populations of plants flowering in late summer and autumn, mainly February to April, but as late as June in tropical Africa. These plants are generally relatively tall and have pink to purple flowers on a many-flowered, inclined spike borne above a fan of several lanceolate to sword-shaped leaves. A second series of populations, restricted to Zimbabwe and adjacent interior Mozambique, flowers in spring, mainly from mid-September to mid-November, but sometimes as early as August. These plants flower before the narrowly sword-shaped foliage leaves have fully emerged (Goldblatt, 1993) and often have a shorter, more highly branched stem. My provisional hypothesis was that the early-blooming plants were stimulated to flower precociously by grassland fires, which are common in late winter and spring, when dry grassland is often deliberately set ablaze before the rains to stimulate growth of new pasture. Fire stimulates flowering in many geophytic plants, and I thought it might promote precocious flowering in *G. crassifolius*. Flowering twice in a year is unknown in other species of *Gladiolus* and is not reported in the species elsewhere across the range of *G. crassifolius*.

I have now received fruiting material of plants conforming to the early-flowering plants of *Gladiolus crassifolius*, and the capsules and seeds do differ significantly from those of the summer–autumn-flowering plants. The latter have capsules 9–12(–14) mm long and wedge- or more or less pear-shaped seeds ca. 4 × 2–3 mm with the wing developed only on one half of the seed, whereas the spring-flowering plants have capsules 12–16 mm long and broadly winged, and oval to round seeds 5–7 × 4–5 mm. The fruit and seed differences have prompted a reappraisal of the spring-flowering *G. crassifolius*. The more lax spikes, slightly smaller flowers, shorter, usually obtuse bracts, and narrow leaves now assume more significance and, taken in combination with the fruit differences, make it seem reasonable to treat the spring-flowering plants as a separate species, *G. mosambicensis* Baker, until now treated as a synonym of *G. crassifolius*.

Apart from the early flowering time, the differences between *Gladiolus mosambicensis* and *G. crassifolius* include a flowering stem with up to four branches, floral bracts with rounded apices and 9–15 mm long, always shorter than the internode above it, and pink to purple flowers somewhat smaller than those of *G. crassifolius*. Its flowers have a perianth tube 8–9 mm long, a dorsal tepal 16–18 mm long, and anthers 6–8 mm long. Perhaps even more significant, the capsules are 12–16 mm long, and the seeds are rounded, 5–7 × 4–5 mm, and have a fully developed wing around the seed body. *Gladiolus crassifolius* normally has stems bearing one or rarely two branches and firm, acute, usually entirely green, acute bracts 9–12(–14) mm long, always somewhat longer than an internode, a perianth tube 12–17 mm long, dorsal tepal 18–22 mm long, and anthers 7–8 mm long. The capsules are 9–12 mm long and the seeds are wedge- to pear-shaped to oval, ca. 4 × 2–3 mm, with the translucent or light brown wing well developed at one or both ends but not on the sides. An illustration of *G. mosambicensis* is available in Plowes and Drummond's (1976) handbook, *Wild Flowers of Rhodesia*, pl. 37. Color and pen-and-ink illustrations of typical *G. crassifolius* can be found in Goldblatt and Manning (1998).

Because the type collection of *Gladiolus mosambicensis* has no date or a precise locality, I have tried to determine where the collector, A. J. Braga, might have collected the type of the species, said to have come from Beira, in central coastal Mozambique, where the plant does not occur. According to information provided by G. V. Pope, Braga traveled from Beira to Mozambique Island in 1895 and returned via Quelimane and the lower Zambezi before passing through the Gorongoza highlands where *G. mosambicensis* has been collected several times. He must have collected what was later named *G. mosambicensis*

there, presumably late in the year. Unfortunately, I have not been able to find more precise dates of Braga's itinerary, but it now seems likely that the type locality is the Gorongoza region of interior Mozambique.

Specimens examined. MOZAMBIQUE. **Manica e Sofala:** Gorongoza Mtns., 1000 m, *Torre & Perreira 12476* (LISC); Gorongoza Mtns. near Morombodzi Falls, *Mendonça 2455* (BM, C, LISC, MO); Gurué, toward Namuli, *Andrada 1860* (COI, LISC). ZIMBABWE. **Manicaland:** Nyanga, Mt. Inyangani, S end of Nyazengu Ridge, *Pope & Muller 1702* (MO, SRGH); Nyanga, Inyanga Downs, dry hillside, *Biegel 246* (MO, SRGH); Chimanimani, Pork Pie [near Chimanimani (Melsetter)], *Munch 321* (MO, SRGH), *Davies 2261* (MO, SRGH); Chimanimani, Rocklands, Melsetter, *Chase 2291* (MO, SRGH); Chimanimani, Mtare, hill near Mozambique border, *Chase 7178* (BM, EA, K, LISC, SRGH); Chimanimani, near Mtare, Oct. 1996 (fr), *Plowes s.n.* (MO). **Mashonaland East:** Makoni, near Headlands, *Plowes 2118* (K, SRGH). **Masvingo:** Zimbabwe Distr., Great Zimbabwe, *Fries, Norlindh & Weimarck 2066* (BM, BR, LD, S). **Midlands:** Bikita Distr., summit of Mt. Buhwa, *Biegel, Pope & Gosden 4333* (C, MO, SRGH, WAG).

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Three New Species of *Eleocharis* (Cyperaceae) from the Andean Páramos of Colombia and Ecuador

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Abstract. Three new closely related species of *Eleocharis* R. Brown (Cyperaceae) from Andean páramos are described from Colombia: *E. fassettii* S. González & P. M. Peterson, *E. cuatrecasii* S. González & P. M. Peterson, and *E. moraosejoana* S. González, C. Ulloa & P. M. Jørgensen. They all belong to *Eleocharis* subgen. *Eleocharis*, sect. *Eleocharis*, and differ from related species by a combination of characters, among which are the thin, loose upper sheath apices and the unusual achene shape that is conspicuously tapered toward the base and apex.

Resumen. Se describen tres nuevas especies de *Eleocharis* R. Brown (Cyperaceae) de Colombia: *E. fassettii* S. González & P. M. Peterson, *E. cuatrecasii* S. González & P. M. Peterson y *E. moraosejoana* S. González, C. Ulloa & P. M. Jørgensen, conocidas solamente de páramos andinos. Todas forman parte de *Eleocharis* subgen. *Eleocharis*, secc. *Eleocharis*. Difieren de las especies relacionadas en una combinación de características entre las que destaca el ápice de la vaina superior delgado y laxo y la forma del aquenio, angostado hacia la base y el ápice.

Key words: Andes, Colombia, Cyperaceae, Ecuador, *Eleocharis*, IUCN Red List, páramo.

Eleocharis R. Brown (Cyperaceae) is a widely distributed genus of more than 200 species (González & Peterson, 1997) that can be distinguished by the following vegetative and reproductive morphological characters: leaves basal and reduced to tubular sheaths, inflorescence reduced to a single spikelet, and a stylopodium that is persistent on the achene. Despite its morphological simplicity, there is broad diversity within *Eleocharis* (González & Peterson, 1997; González & Tena, 2000). The genus was extensively studied by H. K. Svenson between 1929 and 1957 (see Svenson, 1929, 1937, 1957). However, no recent comprehensive worldwide taxonomic treatment of the genus is available (Smith et al., 2002), and many species remain undescribed in Latin America.

Three new closely related species are described here from the páramos in the northern Andes. The North Andean páramos are one of the richest high-elevation mountain ecosystems in the world with high biological diversity and endemism, but they are ecologically fragile and severely threatened by human activities (Luteyn, 1999; Sklenář et al., 2005).

The three new taxa belong in *Eleocharis* subg. *Eleocharis*, sect. *Eleocharis*, which is the most diverse group of the genus in the classification proposed by González and Peterson (1997). Further studies will be necessary to place the species here described in the most appropriate subseries. In their general aspect, presence of horizontal rhizomes, and obscurely trigonous achenes, the new species are morphologically similar to species of *Eleocharis* subser. *Truncatae* Svenson (Svenson, 1932), but differ in the membranous, hyaline or subhyaline, and nontruncate apices of the upper sheaths. Differences with *E. dombeyana* Kunth and *E. montana* (Kunth) Roemer & Schultes, with which specimens of the new species have been erroneously placed according to annotations on herbarium labels, are presented in a key to species below.

1. Eleocharis fassettii S. González & P. M. Peterson, sp. nov. TYPE: Colombia. Santander: Alto del Almorzadero, N of Cerrito, small pond on páramo, 12,500 ft., 31 Oct. 1944, *N. C.*

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Fassett 25994 (holotype, US; isotypes, MO, NY, WIS). Figure 1.

Eleochariti subarticulatae (Nees) Boeckeler similis sed atrospiculis laxifloris, glumis latis et antheris longioribus differt; *E. dombeyanae* Kunth similis sed vaginis superioribus apice membranaceis, leviter obliquis, hyalinis, laxis, absque cuspis et acheniis ellipsoideis vel subfusiformibus leviter reticulatis differt.

Rhizomatous perennials; roots fibrous, brown; rhizomes (1–)2–4 mm wide, long-creeping to ascendant, covered by long scales (sheaths) up to 1 cm × 1–2 mm, purple to black, or stramineous with purple striations, the distal part sometimes foliaceous, the young scales sometimes translucent, red-striate or punctiform, the old scales becoming fibrous; culms 8–28 cm × 0.5–1.2 mm, solitary or tufted, pale green, terete or somewhat flattened when pressed, evidently sulcate or lineolate, usually septate-nodulose, soft, erect or slightly recurved. Leaf sheaths loose, stramineous, often purple-striate or punctiform at the base, membranous, hyaline and red-punctiform distally, slightly oblique, upper sheath apex rounded or sometimes bifid, the mouth concave or slightly cleft. Spikelets lanceoloid or ovoid, 5.5–9 × 1.5–3 mm, 8- to 22-flowered, apex acute; proximal scale empty, persistent, amplexicaulous or almost so, less than 1/3 (often less than 1/5) the length of the spikelet, the midvein region broad, greenish to stramineous, finely nerved, rounded at the apex, with a hyaline margin and apex less than 0.2 mm; floral scales polystichous, appressed or somewhat spreading at the apex, 2–2.8 × 0.7–0.9 mm in lateral view, ecarinate or obscurely carinate at the apex, membranous, ovate, obtuse to acute, with a green or stramineous midvein and dark purple to black sides, the margin and apex not hyaline or the hyaline part less than 0.2 mm wide; hypogynous bristles equaling or longer than the achene, 4 to 7, light reddish brown, finely retrorsely dentate; style trifid; stamens 3, anthers 0.9–2 mm, the connective short, prolonged. Achenes 1.1–1.6 mm (not including the stylopodium), 0.6–0.8 mm wide, obscurely trigonous with the sides convex, or biconvex with the abaxial angle represented by a paler, low ridge, the lateral angles slightly costulate, the achene ellipsoid, subfusiform, or narrowly obovoid, tapered to the base and to the apex, the apex forming a neck, pale to golden yellow or pale brown, somewhat iridescent, very finely reticulate, the pericarp fragile, easily breaking; stylopodium (0.2–)0.3–0.5(–0.9) mm, 0.1–0.2 mm wide at the base, lanceoloid, gray to pale brownish, often on a fine, pale ridge.

Distribution and habitat. *Eleocharis fassettii* is a subaquatic plant that occurs in ponds and wet washout of loose sandstone and other sedimentary rocks from the páramos and chaparral of the Eastern Cordillera (Cordillera Oriental) in Colombia. This area includes the Cocuy region where there is a high diversity of plants (Cleef, 1997). Collection elevations have been reported from 2700 to 3550 m.

IUCN Red List category. *Eleocharis fassettii* fits the IUCN (2001) category of Near Threatened (NT), because of its restricted, patchy distribution, the possibility of habitat degradation by human-mediated fires, and overgrazing practices that are common in the region (Cleef, 1997). The species may be extant within the boundaries of Cocuy and Iguaque National Parks.

Etymology. The epithet honors Norman Carter Fassett (1900–1954), who collected the type specimen. Dr. Fassett was an expert on several groups of aquatic plants and vegetation, and participated in the Colombian Cinchona Project in the 1940s.

Discussion. Collections of *Eleocharis fassettii* have been identified as *E. dombeyana*, which it resembles in general habit and in its mucronate stylopodium. *Eleocharis dombeyana* belongs to *Eleocharis* subser. *Truncatae* and has upper sheaths with a firm, truncate, and evidently cuspidate apex.

In *Eleocharis fassettii*, the narrow stylopodium is usually 0.4–0.5 mm long, but it can be only 0.2 mm when the upper part is broken early, or as long as 0.9 mm when the base of the style is persistent. The shape of the achene, including an apex that is abruptly narrowed into a neck, the long, lanceolate stylopodium, and the general appearance of the plant are morphologically similar to *E. subarticulata*, a species of uncertain placement in *Eleocharis* (Svenson, 1939; da Silva et al., 2005) known from lower elevations in Brazil and Paraguay. Differences between the two species are presented in the key.

Eleocharis subarticulata and *E. fassettii* are morphologically similar, but their taxonomic relationship is unclear. The former species has the lowest chromosome number known in *Eleocharis*: $n = 3$ (da Silva et al., 2005). In the state of Rio de Janeiro, it is recorded only for the Serra do Itatiaia, a region with a puzzling biogeographical history with the Sierra Nevada del Cocuy; this relationship was discussed by Cleef (1997), who reported the presence in the Cocuy area at 4060 m of an aquatic liverwort (*Herbertus oblongifolius* (Stephani) Gradstein & Cleef), otherwise known only from the Itatiaia massif. The Itatiaia massif is the highest area near Rio de Janeiro, reaching 2787 m (Guedes-Bruni & de Lima, 1997). A formation called Atlantic Brazilian paramos of the high altitudes from the Atlantic coastal chain of Brazil, floristically somewhat related to Andean

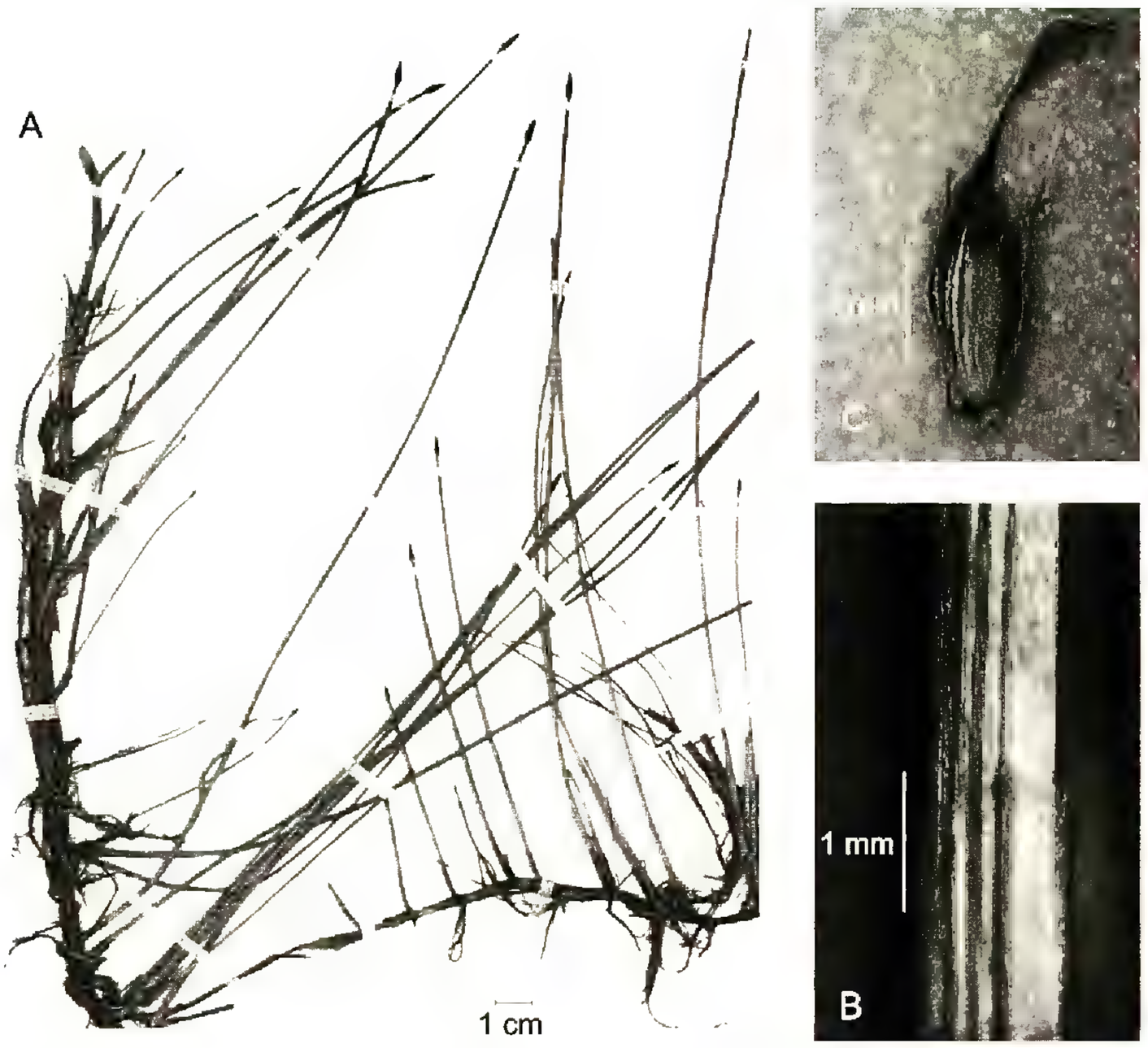

Figure 1. *Eleocharis fassettii* S. González & P. M. Peterson. —A. Habit. —B. Upper portion of distal leaf sheath. —C. Achene. A and B from *G. Smith 1006*; C from *N. C. Fassett 25994*.

páramos, was first described by Schnell in 1987 (cited in a Report by the Institute of Terrestial Ecology, Institut Royal des Sciences Naturelles de Belgique [1996]). The firmer apex of the upper sheaths and fewer-flowered spikelets of the plants identified as *E. subarticulata* from Itatiaia (Gil & Bove, 2007) indicate that they could represent a new taxon or a variety of either *E. fassettii* or *E. subarticulata*, which is otherwise known from much lower elevations.

Paratypes. COLOMBIA. **Depto. Boyacá:** Cordillera Oriental, Sierra Nevada del Cocuy, Quebrada de San Paulino próx. Alto Ritacuva, 7 Apr. 1959, *H. G. Barclay & P. Juajibioy 7316* (COL not seen, MO, US); valley of Río Pomera, 13 km NW of Arcabuco, 20 Aug. 1944, *N. C. Fassett 25644* (NY, US, WIS). **Depto. Cundinamarca:** Cordillera Oriental, hills at W base of Monserrate, E of Bogotá, 13 June 1950, *S. Galen Smith 1006* (COL not seen, K, MO, US).

2. Eleocharis cuatrecasii S. González & P. M. Peterson, sp. nov. TYPE: Colombia. Depto. Antioquia: "Páramo de Sonson" along or near carretera betw. Sonson & Narino, 9000–9600 ft. [not actually páramo, "paramillo"], 23 May 1944, *E. L. Core 729* (holotype, US). Figure 2.

Eleochariti fassetti S. González & P. M. Peterson valde affinis sed habitu minore, caulibus rigidis recurvatis, spiculis paucifloris et squamis infimis longioribus ad 1/2 spiculae longitudinem differt.

Rhizomatous perennials; rhizomes 2–4 mm wide, long-creeping, covered by scales (sheaths) 7–15 × 1.5–2 mm, purple-colored or stramineous with dark purple to black striations, the apex translucent, rounded, the old scales becoming fibrous; culms 1.2–4 cm × 0.3–0.6 mm, in fascicles along the rhizome, pale green, terete, slightly sulcate, rigid and arching or recurved. Leaf sheaths loose, stramineous and purple-striated at the base, membranous and slightly inflated distally, slightly oblique, hyaline and red-punctiform distally, upper sheath apex rounded (sometimes bifid), concave at the ventral part (mouth). Spikelets ovoid, 2–5.6 × 1–3 mm, 2- to 12-flowered, apex acute; proximal scale up to 1/2 the length of the spikelet, sterile, with the midvein broad, greenish to straw-colored, finely nerved; floral scales polystichous, somewhat spreading at the apex, 1.8–2.6 × 0.5–0.7(–0.8) mm in lateral view, obscurely carinate at the apex, membranous, ovate, obtuse to acute, the midvein green or stramineous and dark purple, sometimes with black sides, the margin and apex not hyaline or the hyaline part less than 0.2 mm wide; hypogynous bristles equaling to longer than the achene, 4 to 7, light reddish brown, finely retrorsely dentate; style trifid; stamens 3, anthers 0.8–1 mm, the connective short prolonged. Achenes 1.2–1.4 mm (not including the stylopodium), 0.6–0.7 mm wide, obscurely trigonous with the sides convex, or biconvex with the abaxial angle represented by a paler, low ridge, the lateral angles slightly costulate, the achene narrowly obovoid to subfusiform, the apex forming a neck, pale to golden yellow or pale brown, somewhat iridescent, very finely reticulate, the pericarp often breaking along from the base to the apex; stylopodium

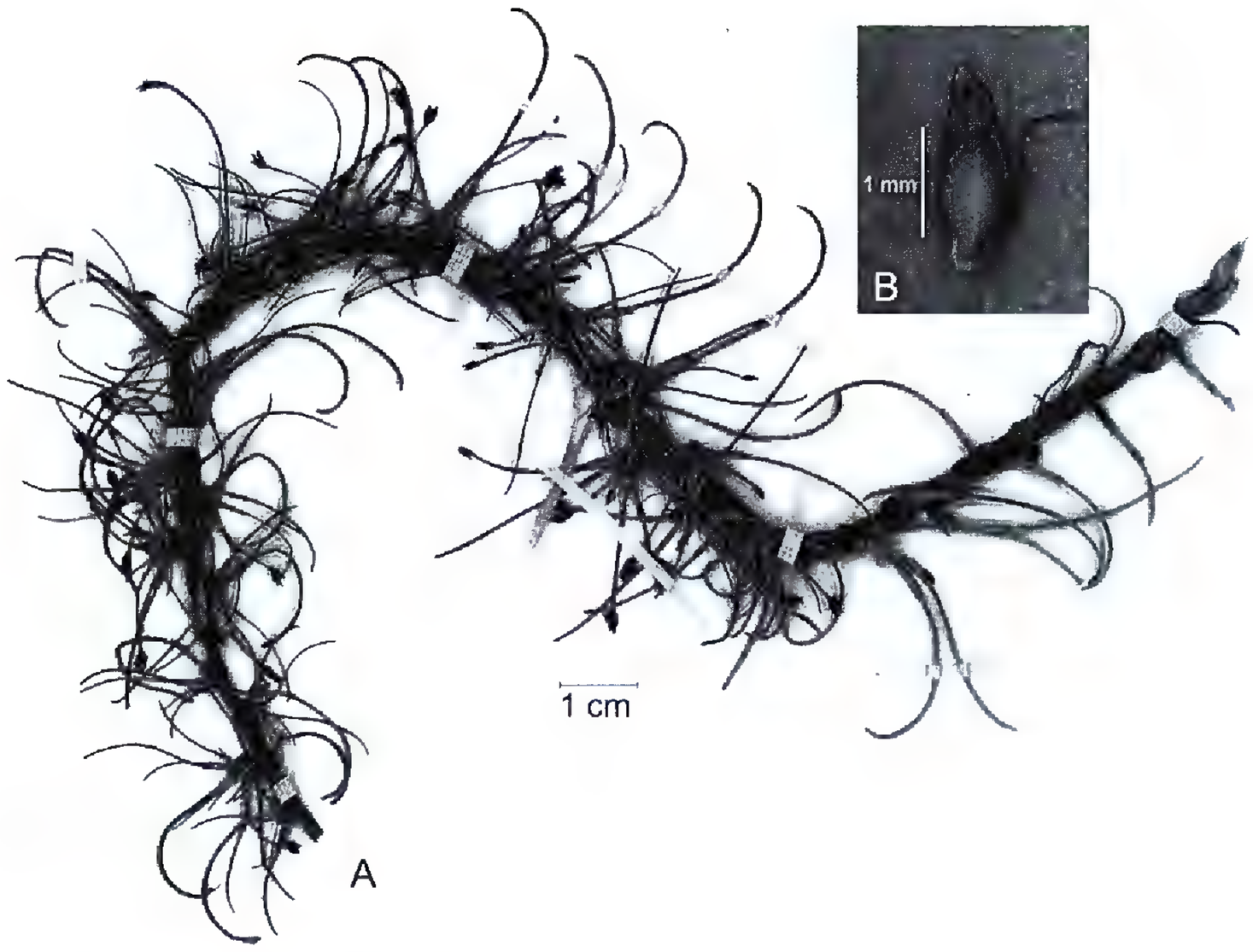

Figure 2. *Eleocharis cuatrecasii* S. González & P. M. Peterson. —A. Habit. —B. Achene. A and B from *E. L. Core 729* (US).

(0.3–)0.4 mm long, 0.15–0.2 mm wide at the base, lanceoloid, gray to pale brown-colored.

Distribution and habitat. This species appears to be a narrow endemic and is only known from the type collection in the Cordillera Central of Colombia between 2735 and 2920 m.

IUCN Red List category. It is problematic to assign an IUCN conservation status to species only known by the type collection (Valencia et al., 2000); however, its limited occurrence would fit the category of Critically Endangered (CR), according to IUCN Red List criteria (IUCN, 2001).

Etymology. The epithet honors the outstanding botanist, José Cuatrecasas (1903–1996), who was Spanish by birth, an American citizen since 1953, and a passionate student of the Colombian flora since his first trip to the country in 1932. His words, "There is nothing better than botany and the páramos" (García Kirkbride, 1997), are a reflection of this.

3. Eleocharis moraosejoana S. González, C. Ulloa & P. M. Jørgensen, sp. nov. TYPE: Colombia. Depto. Nariño: Cumbal, páramo shore or lake, 4000 m, 24 Mar. 1941, *K. von Sneidern s.n.* (holotype, NY; isotype, LL). Figure 3.

Planta *Eleochariti fassetti* S. González & P. M. Peterson similis sed culmis crassitudine 2- ad 3-plo maioribus, vaginis superioribus apice chartaceis, cuspidatis et spicula longiora, squamis floralibus longioribus differt.

Perennials, probably rhizomatous; culms 24–53 cm × 2.3–3.5 mm, in fascicles, sometimes solitary, erect, green, spongy, terete or somewhat flattened when pressed, longitudinally striate, appearing septate-nodulose, the internal septae incomplete. Leaf sheaths loose, papery, stramineous or light purple at the base, pale green or stramineous above, upper sheath apex subtruncate to slightly oblique, the margin hyaline with red dots at the union with the rest of the sheath, cuspidate, the cusp 0.4–1 mm, green or dark purple to almost black. Spikelets cylindric to lanceoloid, 13–25 × 2.6–4.6 mm, ca. 35- to 120-flowered, apex acute; 2 proximal scales ± equal, lacking a flower, the main body 1.5–2.4 mm wide, broad, finely nerved, greenish to stramineous, appearing to be a continuation of the culm, apex up to 1.1 mm, rounded or acute with a dark purple to black border, margin and apex hyaline; floral scales 2.8–4.7 × 0.6–1.1 mm in lateral view, polystichous, aplicate, ecarinate, membranous, oblong to lanceolate, apex acute or obtuse, with a broad green or stramineous midvein region contrasting with the reddish to dark purple or almost black sides, the margin and apex hyaline; hypogynous bristles equaling to longer than achene, 4 to 7, stramineous to light reddish brown, retrorsely dentate; style trifid; stamens 3, the filaments sometimes dark-colored, anthers 1.2–1.7 mm, the connective prolonged. Achenes 1.4–1.7 mm (not including the stylopodium), 0.7–0.8 mm wide, obscurely trigonous or plano-convex with the abaxial angle represented by a paler, low ridge, the angles costulate, the achene ellipsoid to subfusiform, narrowed to the base and to the apex, the apex gradually narrowed into a short neck, finely punctate-reticulate with longitudinal cells, shiny and yellow to olivaceous or reddish, ripening to dark brown or

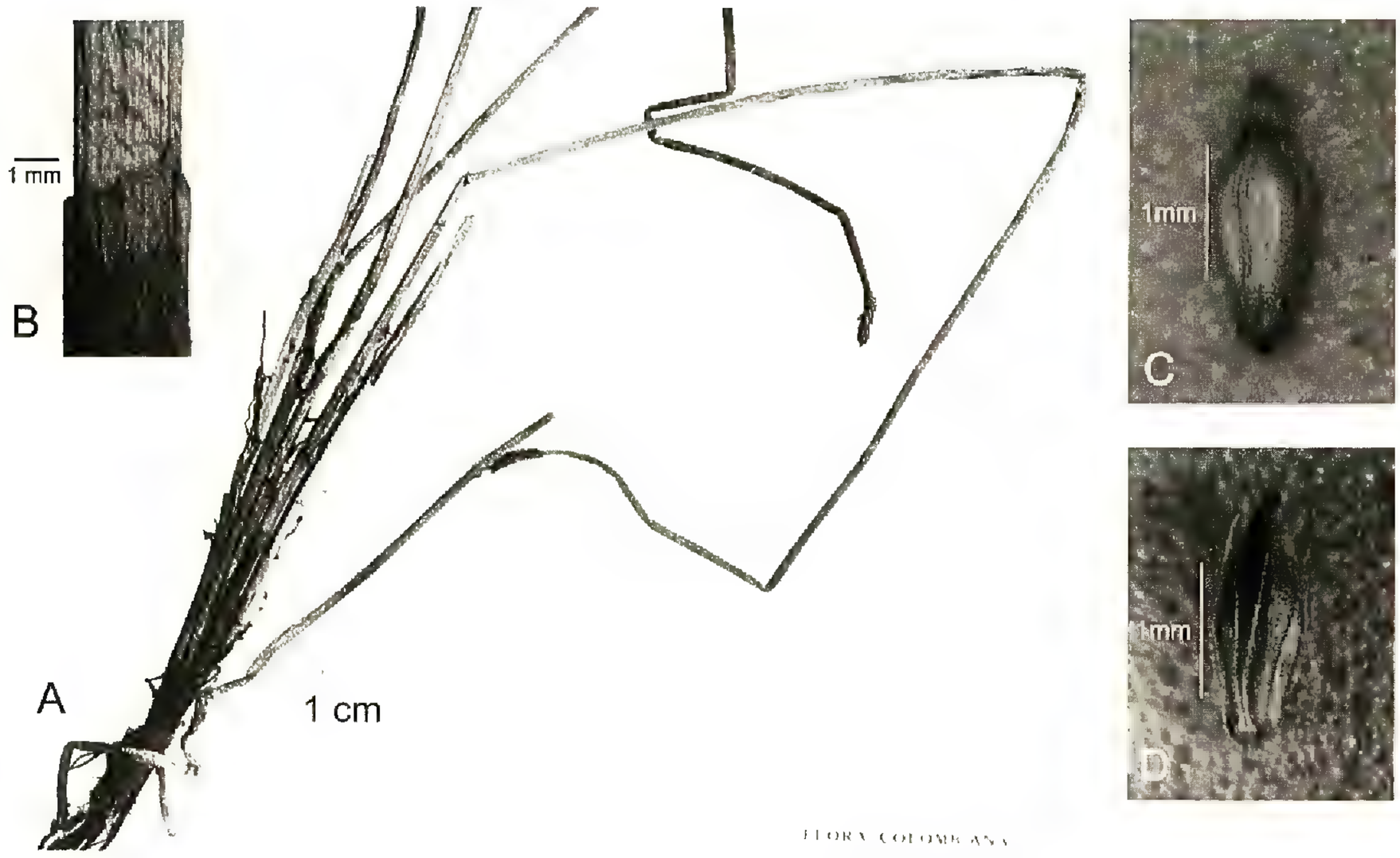

Figure 3. *Eleocharis moraosejoana* S. González, C. Ulloa & P. M. Jørgensen. —A. Habit. —B. Upper portion of distal leaf sheath. —C. Achene, bristles, and filaments removed. —D. Achene. A, B, and C from *K. von Sneidern s.n.*; D from *W. B. Drew E-473*.

sometimes becoming paler and dull; stylopodium 0.2–0.5 mm long, 0.2–0.3 mm wide at the base, narrowly pyramidal, whitish or dark brown, somewhat spongy at least at the base and papillate at ×30, often on a fine, pale or dark ridge.

Distribution and habitat. *Eleocharis moraosejoana* is apparently an uncommon endemic known only from two localities: the eastern slopes of Volcán de Chiles in the Cordillera Occidental of Ecuador from wet swales of páramo associated with *Juncus* L. (as seen on paratype), and the type locality in southwestern Colombia, from a lakeshore in the páramo on the Cumbal volcano. This record adds the genus *Eleocharis* to the genera known from the páramos of the Nariño volcanoes, as listed in Rangel and Garzón (1997). Elevations for collections have been reported from 3495 to 4000 m.

IUCN Red List category. *Eleocharis moraosejoana* could be considered in the IUCN (2001) category of Critically Endangered (CR) given its restricted distribution, possible habitat loss, its rarity (i.e., known only from two collections 25 km apart, both from the 1940s), and the recent history of intense fires in the area (Ramsay, 2001). The specimens were collected from a region that has only partial floristic inventories (Mendoza & Ramírez, 2000; Ramsay, 2001; Peñafiel Cevallos, 2003) and still remains poorly known. It may occur within the boundaries of Ecological Reserve of El Ángel in northern Ecuador.

Etymology. The epithet honors the Colombian botanist, Luis Eduardo Mora-Osejo (1931–2004), a native of Nariño and a specialist in Cyperaceae and in several other families. Dr. Mora-Osejo was "doubtlessly the most eminent botanist of Colombia" (González, 2004).

Discussion. *Eleocharis moraosejoana* is morphologically similar to *E. fassettii*, as indicated by the similar shape and size of the achenes. However, *E. moraosejoana* is a more robust plant (culms 24–53 cm vs. 8–28 cm in *E. fassettii*) with a cuspidate apex of the upper sheaths, larger spikelets (13–25 × 2.6–4.6 mm vs. 5.5–9 × 1.5–3 mm), longer floral scales (2.8–4.7 mm vs. 2–2.8 mm), and different proximal floral scales. The external aspect of *E. moraosejoana* is similar to *E. densa* Bentham, from Mexico and Central America. However, *E. densa* has more densely flowered spikelets, as well as obovate, biconvex achenes that are thicker, wider, and more finely reticulated.

A note on the type specimen at NY indicates that this species was perceived as similar to *Eleocharis nodulosa* (Roth) Schultes (= *E. montana*). Although *E. moraosejoana* is superficially similar to *E. montana*, *E. moraosejoana* is a coarser plant with irregular internal septa (that sometimes appear as complete septa when only a layer of the spongy interior is viewed), apex of the upper sheaths subtruncate to oblique, fewer-flowered spikelets, and ellipsoid to subfusiform achenes.

Paratype. ECUADOR. **Prov. Carchi:** Cordillera Occidental, E slopes of Volcán de Chiles, above Tufino [Ecuadorian Chinchona Mission], 17 Aug. 1944, *W. B. Drew E-473* (NY, US).

Key to New and Morphologically Similar Species of *Eleocharis* in Colombia and Ecuador

1a. Distal portion of upper sheaths herbaceous to papery, the apex truncate, thickened, and abruptly cuspidate; achenes obovoid to obpyriform, not narrowed to the apex or base 2
2a. Culms internally with regular, complete transverse septa (which are evident or not externally); achenes evidently reticulate at ×30 . . . . . *E. montana*
2b. Culms internally lacking complete transverse septa; achenes smooth to papillose at ×30 . . . . . *E. dombeyana*
1b. Distal portion of upper sheaths membranous or papery, the apex oblique, thin, lacking a cusp or subtruncate and with a cusp (in *E. moraosejoana*); achenes ellipsoid, fusiform, or narrowly obovoid, narrowed to the apex and to the base 3
3a. Floral scales 0.5–0.6 mm wide in lateral view, densely crowded, greenish to castaneous with a castaneous or dark purple border; anthers 0.5–0.7 mm long; achenes deeply reticulate; known from 200–900(–1200) m in Brazil and Paraguay . . . . . *E. subarticulata*
3b. Floral scales 0.5–1.1 mm wide in lateral view, in dense or lax arrangements, greenish or stramineous on midvein, sides castaneous to dark purple or almost black; anthers 0.8–2 mm long; achenes finely reticulate; known from 2700–4000 m in Andean páramos 4
4a. Culms 2.3–3.5 mm wide; apex of the upper sheaths cuspidate; spikelets 13–25 mm long; floral scales 2.8–4.7 mm long . . . . . *E. moraosejoana*
4b. Culms 0.3–1.2 mm wide; apex of the upper sheaths not cuspidate; spikelets 2–9 mm long; floral scales 1.8–2.8 mm long 5
5a. Rhizomes creeping to ascendant; culms 8–28 cm × 0.5–1.2 mm, soft, not or slightly recurved; spikelets 5.5–9 mm long, 8- to 22-flowered; proximal scale less than 1/3 the length of the spikelet; anthers 0.9–2 mm long. . . . . *E. fassettii*
5b. Rhizomes creeping; culms 1.2–4 cm × 0.3–0.6 mm, rigid and recurved; spikelets 2–5.6 mm long, 2- to 12-flowered; proximal scale 1/3–1/2 the length of the spikelet; anthers 0.8–1 mm long . . . . . *E. cuatrecasii*

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Piper giordanoi (Piperaceae): A New Species from Southeastern Brazil

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Abstract. A new species, *Piper giordanoi* E. F. Guimarães & D. Monteiro, from Rio de Janeiro state, southeastern Brazil, is described and illustrated. The taxon is related to *P. weddellii* C. DC. and *P. sampaioi* Yuncker. The new species differs in its shrubby habit and longer petioles. The lack of submarginal trichomes on the abaxial leaf surface distinguishes *P. giordanoi* from *P. sampaioi*.

Resumo. *Piper giordanoi* E. F. Guimarães & D. Monteiro, uma nova espécie do estado do Rio de Janeiro, sudeste do Brasil, é descrita e ilustrada. O táxon está relacionado a *P. weddellii* C. DC. e *P. sampaioi* Yuncker. A nova espécie difere de ambos, por ser um arbusto com pecíolos mais longos. A ausência de tricomas submarginais na face abaxial da superfície foliar distingue *P. giordanoi* de *P. sampaioi*.

Key words: Brazil, IUCN Red List, *Piper*, Piperaceae.

Recent collections in different ecosystems have improved the knowledge of Piperaceae's biodiversity in Brazil. *Piper* L., the largest genus within the Piperaceae, has a pantropical distribution and includes ca. 330 Brazilian taxa (Yuncker, 1972, 1973) that inhabit mainly shrubby strata in dense ombrophilous forests, gallery woods, and rocky formations. The genus is characterized by its subshrubby or shrubby habit, and by its achlamydeous flowers protected by different forms of bracteoles and grouped in spikes, racemes, or umbels. Flowers in the genus have two to five stamens and a superior unilocular ovary, the fruits are stylose or sessile, and the seeds have abundant perisperm.

The circumscription of the genus *Piper* is very heterogeneous and segregated in many groups (Kunth, 1839; Miquel, 1843; de Candolle, 1869; Tebbs, 1989). The subgenus *Schilleria* Kunth includes approximately 30 taxa occurring in southeastern Brazil and in Central America, and has been supported as a monophyletic group (Callejas, 1986; Jaramillo & Manos, 2001). These take the form of shrubs, sometimes sarmentose, commonly glabrous, multiply to pinnately nerved throughout, sometimes with callosities at the base. The prophylls are glabrous and acute at the apex. The bracteoles are cucullate, crescent-shaped, pedicellate, glabrous to pubescent, but never marginally ciliate. There are three or four stamens, with the filaments distinctly longer than the anthers, and the three carpels have sessile stigmas. The fruits are glabrous, trigonous, obovoid, and laterally compressed.

In this paper a new species is described, assigned to *Piper* subg. *Schilleria*. The original description is based on material from the Rio das Pedras Reserve, an area of 1400 ha. in the Atlantic Forest region, found in Mangaratiba, a municipality in western Rio de Janeiro state, Brazil.

Piper giordanoi E. F. Guimarães & D. Monteiro, sp. nov. TYPE: Brazil. Rio de Janeiro: Mangaratiba, Reserva Rio das Pedras, 22°59′S, 44°05′W, trilha para a Lagoa Seca, ca. 350 m, 26 May 1998 (fl, fr), *L. C. Giordano 2147* (holotype, RB; isotype, MO). Figure 1.

Frutex 0.5–1.8 m; caule tereti, striato, hirtello; foliis ovatis, ellipticis, lanceolatis, basi cordata lobis aequalibus vel leviter inaequalibus, 11–17 × 3.2–5.7 cm; petiolo 1–1.5 cm longo, vagina basali brevi praedito; nerviis utrinque 10 ad 12, subter hirtellis; spicis 3–6 cm longis, 0.1–0.2 mm diam.; pedunculo 0.8–1 cm longo, hirto; bracteolis cucullato-lunatis, ad basem pedunculi paulo fimbriatis; staminibus 3; stigmatibus 3, sessilibus; fructibus trigonis, ad apicem convexis.

Shrub 0.5–1.8 m tall; internodes 4–9 cm; stems ca. 3 mm, terete, hirtellous to glabrescent, striate. Prophylls 0.5–1 cm, caducous, glabrous, lanceolate, acute and curved at the apex; leaves alternate, petiole 1–1.5 cm, striate, hirtellous, with a short basal sheath; blade 11–17 × 3.2–5.7 cm, ovate, elliptic, lanceolate or oblong-lanceolate, apex acute to acuminate or falcate-acuminate, base cordate with symmetric or slightly asymmetric lobes, one side differing from the other by 1–3 mm, sometimes with callosities; blade surfaces papyraceous to submembranaceous, discolorous, adaxially glabrous, lepidote, the abaxial surface with hirtellous trichomes along the veins, brown-glandulous; veins patterned as eucamptodro-

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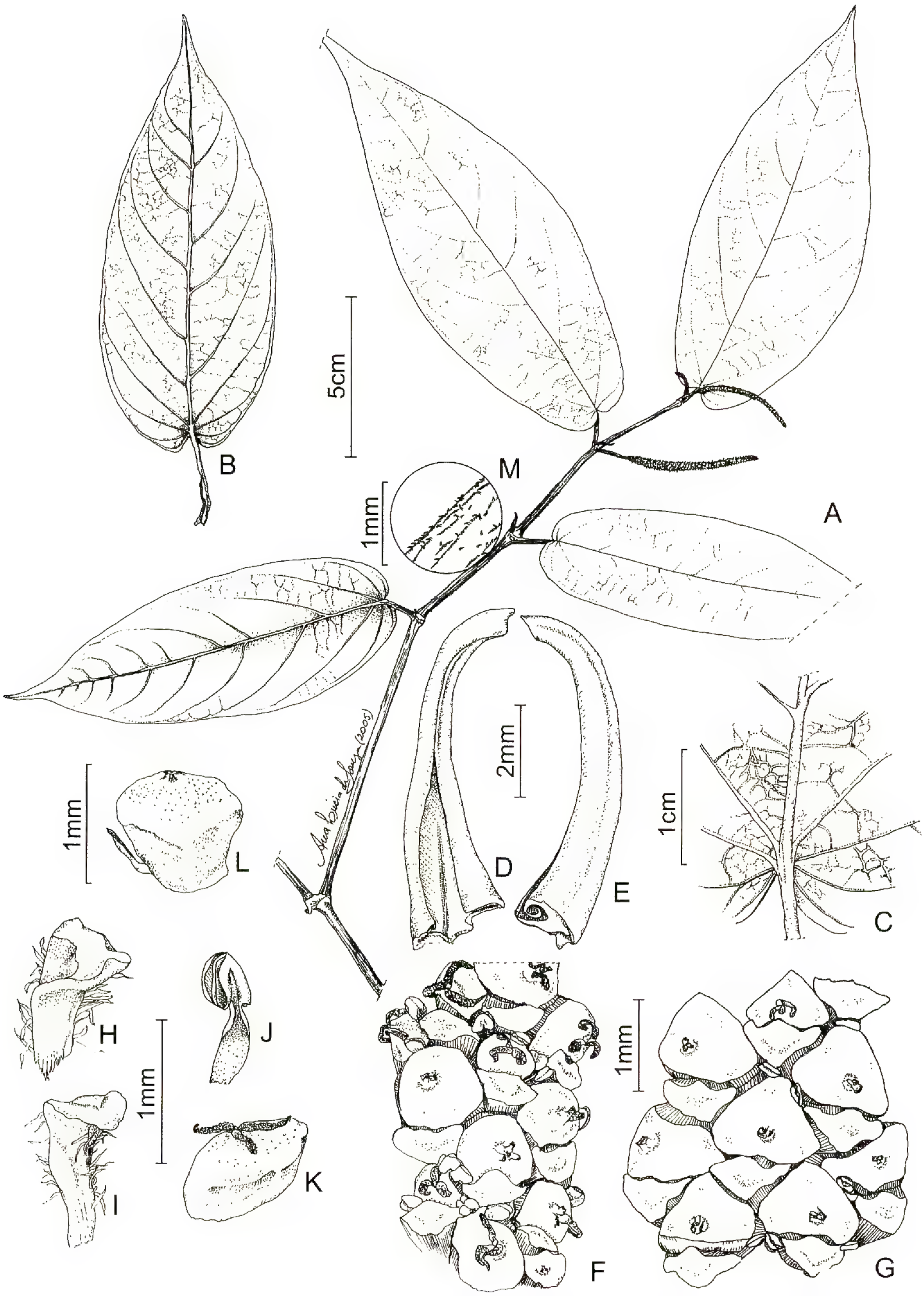

Figure 1. *Piper giordanoi* E. F. Guimarães & D. Monteiro. —A. Habit. —B. Leaf. —C. Base of leaf. —D, E. Prophylls. —F. Young spike detail. —G. Fruit spike details. —H, I. Bracteoles. —J. Stamen. —K. Ovary. —L. Fruit. Drawn from the holotype *L. C. Giordano 2147* (RB). —M. Stem details.

mous to brochidodromous, with 10 to 12 secondary veins, in upward direction from the base to the blade apex; midrib slightly impressed adaxially. Spikes 3–6 × 0.1–0.2 cm, erect; peduncle 0.8–1 cm, erect; bracteoles cucullate to crescent-shaped, sparsely fimbriate at peduncle base. Flowers achlamydeous; stamens 3, filaments ca. 0.5 mm, anthers with an apical-longitudinal dehiscence; ovary rounded; stig-

mas 3, sessile, 0.3–0.5 mm, filiform, recurved, caducous. Fruit ca. 1 mm diam., trigonous, the apex convex, glabrous, lepidote-glandular.

Distribution, habitat, and IUCN Red List category. *Piper giordanoi* is restricted to Rio de Janeiro state, Brazil. It grows on dense hillsides, in ombrophilous forests and humid environments, sometimes in secondary vegetation, at elevations from 200–450 m. The habitat ranges from sunny to semi-shaded sites. Despite its location in the Rio das Pedras Reserve, environmental aggressions such as hunting and palm heart extraction are still a threat (Medeiros et al., 2004). Due to the species' restricted occurrence and small population size, *P. giordanoi* should be considered Critically Endangered (CR B1ab[i,ii,iii]+2ab[i,ii,iii]) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Collected with flowers in May and fruits in May and October.

Etymology. *Piper giordanoi* was named in honor of the collector of the type specimen, Luis Carlos da Silva Giordano (Rio de Janeiro Botanical Garden).

Relationships. *Piper giordanoi* is characterized by its shrubby habit, glabrous adaxial leaf surfaces, leaf blades with cordate and symmetric to slightly asymmetric bases from which secondary veins diverge toward the blade apex, a cucullate to crescent-shaped bracteole, and pyramidal fruit with convex apex. The new species, assigned to subgenus *Schilleria*, is related to *P. weddellii* C. DC. and *P. sampaioi* Yuncker, differing from both in having longer petioles (3–4 mm and 1–2 mm, respectively) and from the latter in the absence of submarginal trichomes on the abaxial leaf surface.

Paratypes. BRAZIL. **Rio de Janeiro:** Mangaratiba, Reserva Rio das Pedras, trilha para a lagoa seca, 25 May 1997 (fl, fr), *J. A. Lira Neto 567* (RUSU); trilha da lagoa seca, 26 May 1998 (fl), *R. C. Lopes 99* (K, RUSU); trilha para a lagoa seca, 27 May 1997 (fl, fr), *M. G. Bovini 1184* (RUSU); Toca da Aranha, 21 Oct. 1997 (fr), *J. M. A. Braga 4374* (RUSU, SP).

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Two New Species of *Baccharis* (Asteraceae, Astereae) from Southern Brazil

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Abstract. Two new species of *Baccharis* L. assigned to subgenus *Molina* Heering and section *Caulopterae* DC. (Asteraceae, Astereae) are described and illustrated from southern Brazil. *Baccharis jocheniana* G. Heiden & Macias is distinguished by its erect-prostrate growth habit, broadly 3-winged stems, reduced scale leaves, panicles composed of spikes of solitary to 6-clustered capitula, female capitula with 50 to 60 florets with an irregularly denticulate corolla apex, and ca. 8-ribbed cypselae. *Baccharis ramboi* G. Heiden & Macias is distinguished by its glabrescent hispid indument, narrowly 3-winged stems, shortly petiolate leaves with oblong leaf blades, capitula clustered in a spike with a narrowly winged axis and conspicuous leafy bracts, female capitula with ca. 30 to 35 florets with a short ligulate apex, and cypselae with two ribs more conspicuous than the others. *Baccharis jocheniana* is compared with *B. myriocephala* DC. and *B. crispa* Sprengel; *B. ramboi* is compared with *B. pseudovillosa* Malagarriga & J. E. Vidal.

Resumo. Duas novas espécies de *Baccharis* L. pertencentes ao subg. *Molina* Heering e sect. *Caulopterae* DC. (Asteraceae, Astereae) do sul do Brasil são descritas e ilustradas. *Baccharis jocheniana* G. Heiden & Macias é caracterizada por apresentar hábito de crescimento ereto-prostrado, caules largamente 3-alados, folhas reduzidas escamiformes, inflorescência constituída por panículas de espigas de capítulos isolados ou em grupos de seis, capítulos femininos com 50 a 60 flores com ápice da corola denticulado e cipselas ca. 8-costadas. *Baccharis ramboi* G. Heiden & Macias é caracterizada por apresentar indumento híspido, glabrescente, caule estreitamente 3-alado, folhas com pecíolos curtos e limbo foliar oblongo, capítulos agrupados em uma espiga com eixo estreitamente alado portando brácteas folhosas conspícuas, capítulos femininos com 30 a 35 flores com ápice da corola curtamente ligulado e cipselas com duas costelas mais conspícuas. *Baccharis jocheniana* é comparada com *B. myriocephala* DC. e *B. crispa* Sprengel *Baccharis ramboi* é comparada com *B. pseudovillosa* Malagarriga & J. E. Vidal.

Key words: Asteraceae, Baccharidinae, *Baccharis*, Brazil, carqueja, Compositae, IUCN Red List.

The genus *Baccharis* L. comprises ca. 375 species (Giuliano, 2005) originally distributed exclusively in the Americas, from southern Canada (Fielding, 2001) to southern South America. These species occur in a great diversity of environments, playing an important role in several plant communities (Giuliano, 2001). The most important centers of species richness are the Andes from Colombia to central Chile and central Argentina, and the mountains of southeastern Brazil, Uruguay, and eastern Paraguay (Müller, 2006). About 150 species are found in Brazil, most of them concentrated between the southeastern states of Minas Gerais, Rio de Janeiro, and São Paulo, and the southern states of Paraná, Santa Catarina, and Rio Grande do Sul.

During the studies for a taxonomic revision for *Baccharis* sect. *Caulopterae* DC. of Rio Grande do Sul, Brazil, two species were recognized as undescribed. Concerning the infrageneric classification, the new species are assigned here to *Baccharis* subg. *Molina* Heering and to section *Caulopterae* DC.

1. Baccharis jocheniana G. Heiden & Macias. TYPE: Brazil. Rio Grande do Sul: São Lourenço do Sul, Passo do Coqueiro, Mar. 2006 (♀), *G. Heiden 650* (holotype, PEL 24704; isotypes, Herbário da Embrapa Clima Temperado, MO). Figure 1.

Species *Baccharidi myriocephalae* DC. habitu, alis caulis principalis latis et ramis erecto-patentibus similis; sed

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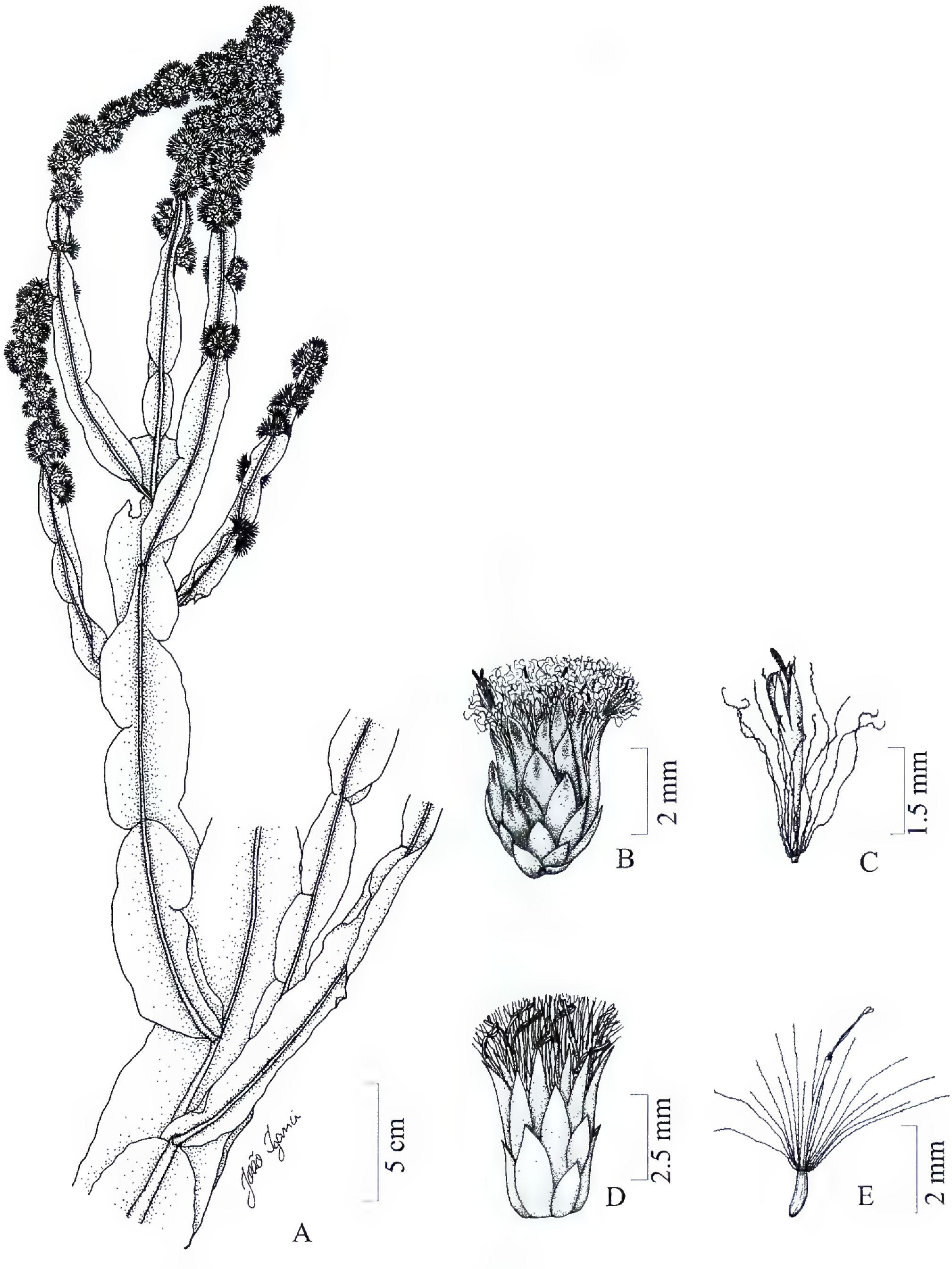

Figure 1. *Baccharis jocheniana* G. Heiden & Macias. —A. Habit of fertile shoot. —B. Male capitulum. —C. Male floret. —D. Female capitulum. —E. Female floret. A, D, and E drawn from paratype (*G. Heiden 386*, PEL 24702); B and C drawn from paratype (*J. C. Sacco 567*, PEL).

inflorescentia in spicis contracta, axe inflorescentiae alis latioribus, 1–2.5 cm latis; involucro capitulorum foemineorum latius (4.5–5 mm lato); capitulis foemineis 50 ad 60 floribus (non 30 ad 40 floribus) munitis, corolla florum foemineorum apice dentato, et capitulo masculo 35 ad 40 floribus (non 15 ad 20 floribus) munito differt.

Dioecious shrub, 1–2.5 m tall; stems erect-prostrate or scandent, branched, 3-winged, wings flat to undulate, resinous, 1.5–10 × 1–2.5 cm, appearing superficially glabrous but covered by a microindument of tufted hairs, under a resin layer. Leaves alternate, resinous, sessile; leaf blades reduced to scales. Capitula sessile, in pseudospikes of clusters of 1 to 6 capitula; pseudospikes forming apical or axillary panicles; involucre of male capitula 4- to 6-seriate, oblong to campanulate, 4.5–5 × 4–4.5 mm;

florets ca. 40; phyllaries pale green, dentition of phyllary margins short-dentate, margins narrowly scarious, light yellow, outer phyllaries ovate, inner phyllaries linear, phyllary apices acute; corolla ca. 3 mm, 5-lobed; anthers inserted, styles 3.5 mm, presence of sweeping hairs on the style-tip, apex of style-tip not branched; pappus uniseriate, 3.5 mm; involucre of female capitula 4- or 5-seriate, oblong, 5.5–6 × 4.5–5 mm; florets 50–60; phyllaries pale green, dentition of phyllary margins short-dentate, margins narrowly scarious, light yellow, outer phyllaries oblong, inner phyllaries linear, phyllary apices acute; corolla 3–3.5 mm, with irregularly denticulate apex, rays 2 to 5; styles ca. 4 mm, with connivent branches. Cypselae oblong, straw-colored, ca. 1.5 × 0.5 mm, ca. 8-ribbed; pappus uniseriate, ca. 4.5 mm, not accrescent at maturity.

Distribution, habitat, and IUCN Red List category. *Baccharis jocheniana* is endemic to southeastern Rio Grande do Sul state, in southernmost Brazil. It is usually found, often as a scandent plant, in subtropical seasonally dry forests near rocks and water courses. Sometimes it is found as erect prostrate individuals in open habitats on rocky edges and springs in subtropical grasslands. There is no information available estimating the actual size of the overall plant population, but the natural area of occupancy of the species was reduced considerably since the displacement by human activities of the subtropical seasonally dry forests from southeastern Rio Grande do Sul two centuries ago. The remnants of this forest are still being deforested for wood and agriculture, the last fragments being substituted by large-scale wood plantations of *Eucalyptus* L'Héritier. Reduction of habitat area and changes in native species dynamics caused by the wood plantations are currently the major threats to this and other similarly distributed endemics in southern Brazil. Taking into account the scant information available for the recently described species, we provide a preliminary conservation assessment of Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Etymology. *Baccharis jocheniana* is named to honor the German botanist and researcher of the subtribe Baccharidinae, Jochen Müller.

Discussion. *Baccharis jocheniana* has often been misidentified as *B. trimera* (Lessing) DC. (synonym of *B. crispa* Sprengel) due to the 3-winged stem, and is closely related to *B. myriocephala* DC. While the range of *B. jocheniana* overlaps completely with *B. crispa* (occurring in Brazil, north to São Paulo, Argentina, and Uruguay), it does not occur with *B. myriocephala* (from Brazil, north to Bahia, and south to Rio Grande do Sul at 30°S). These species overlap around the parallel 30°S, the northern limit to the distributional area of *B. jocheniana*. The species differs from *B. crispa* in several traits such as the shrubby and erect-prostrate to scandent habit (vs. subshrubby and erect), usual occurrence in shady habitats (vs. usually occurring in sunny habitats), broader stem wings (1–2.5 cm vs. 0.5–1 cm wide), and female florets with denticulate corolla apex (vs. truncate).

Baccharis jocheniana resembles *B. myriocephala* in its habit and broad main stem wings. However, in *B. myriocephala* wings of the inflorescence axis are much narrower (0.1–0.5 cm wide), the involucre of female capitula is narrower (3–4 mm wide) and bears fewer florets (15 to 20 in male heads and 30 to 40 in female heads), and the corolla apex of female florets is truncate.

Paratypes. BRAZIL. **Rio Grande do Sul:** Capão do Leão, I. A. S. Horto Botânico, 21 Mar. 1950, *J. Gomes s.n.* (PACA 68809); Caxias do Sul, Ana Rech, 19 Mar. 2000, *A. Kegler 887* (Herbário da Universidade de Caxias do Sul 15485), Conceição, 20 June 1987, *R. Wasum s.n.* (Herbário da Universidade de Caxias do Sul 2995), Pinhal, 9 Mar. 2000, *A. Kegler 794* (Herbário da Universidade de Caxias do Sul 15987); Jaquirana, 26 Oct. 1986, *R. Wasum s.n.* (Herbário da Universidade de Caxias do Sul 2108); Pelotas, 12 Mar. 1956, *Schlichting s.n.* (PACA 63053), Cerrito Alegre, 8 Mar. 1956 (♂), *J. C. Sacco 567* (PEL 1539; RB 106818); Porto Alegre, Vila Manresa, 3 Mar. 1950, *B. Rambo S.J. s.n.* (PACA 46051); São Francisco de Paula, Cazuza Ferreira, Faz. Enxovia, 7 Nov. 1987, *G. G. Grazziotin s.n.* (Herbário da Universidade de Caxias do Sul 3488), RS-235, 8 Oct. 2000, *R. A. Wasum 694* (PACA 85822); São Lourenço do Sul, Boa Vista, June 2004 (♀), *G. Heiden s.n.* (JE, PEL 24700, RB), Aug. 2005 (♀), *G. Heiden 384* (JE, PEL 24701), Aug. 2005 (♀), *G. Heiden 385* (PEL 24703), Aug. 2005 (♀), *G. Heiden 386* (JE, PEL 24702).

2. Baccharis ramboi G. Heiden & Macias, sp. nov. TYPE: Brazil. Rio Grande do Sul: Osório, Faz. do Arroio, 6 Mar. 1950 (♀), *B. Rambo S.J. s.n.* (holotype, PACA 46155). Figure 2.

Species *Baccharidis pseudovillosae* Malagarriga & J. Vidal habitu, indumento conspicue praesenti similis, sed indumento hispido, foliis orbicularibus vel oblongis et bracteis foliaceis differt.

Dioecious subshrub, glabrescent, hispid, 0.3–0.75 m tall; stems erect, branched, 3-winged, wings flat, strongly resinous, 0.75–7 × 0.1–0.5 cm. Leaves alternate, strongly resinous, short-petiolate; leaf blades oblong, apex acute, base rounded to cordate, margins ciliate, venation pinnate. Capitula clustered in a spike with narrowly winged (0.1–0.3 cm wide) axis, with conspicuous leafy bracts; involucre of male capitula 3- or 4-seriate, oblong, ca. 3.5–4 × 2.5–3 mm; florets 20 to 25; phyllaries light brown at the

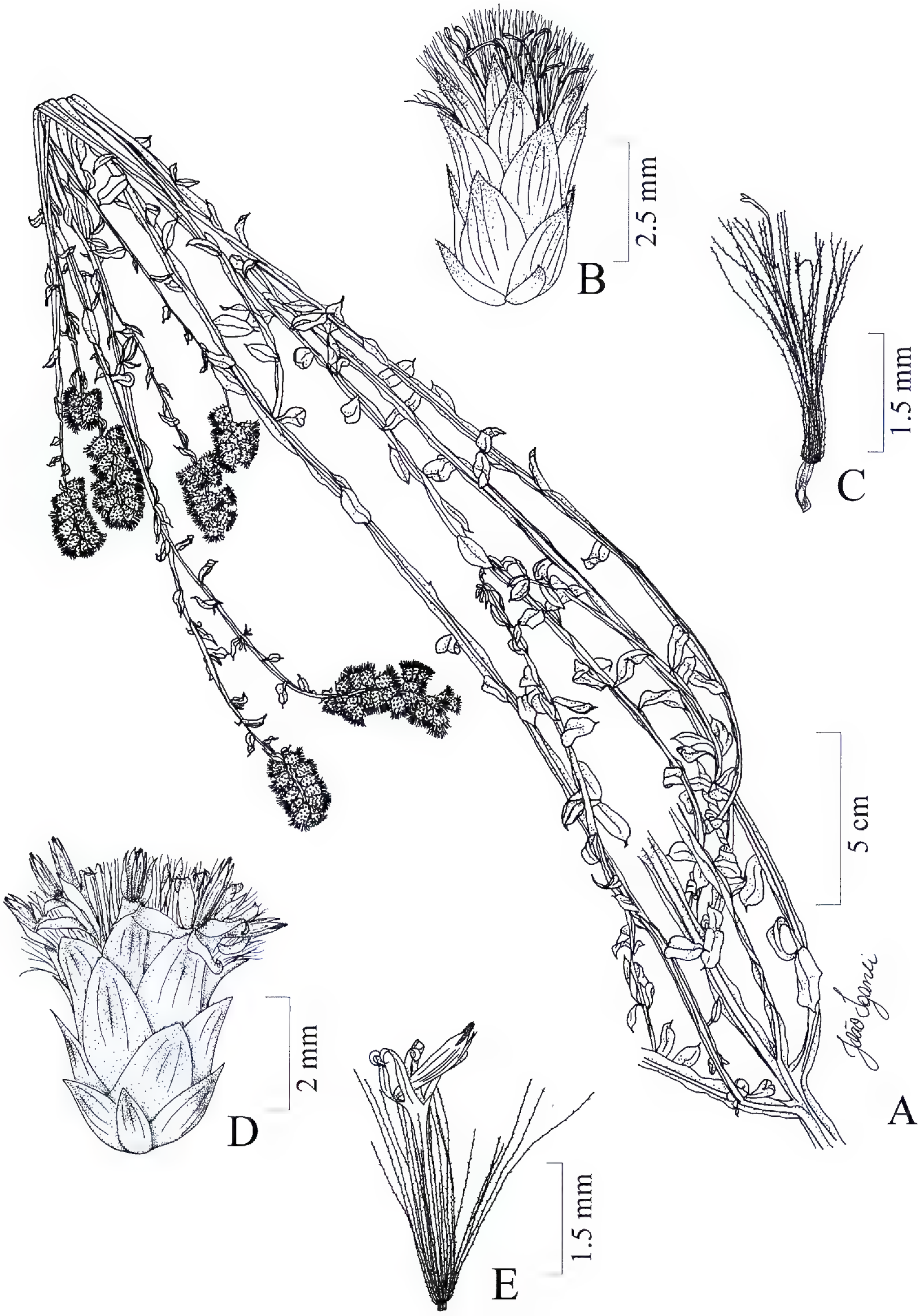

Figure 2. *Baccharis ramboi* G. Heiden & Macias. —A. Habit of fertile shoot. —B. Male capitulum. —C. Male floret. —D. Female capitulum. —E. Female floret. A, D, and E drawn from holotype (*B. Rambo S.J. s.n.*, PACA 46155); B and C drawn from paratype (*E. Pereira 8370 & G. Pabst 7645*, PEL).

base and dark brown at the apex, dentition of phyllary margins fimbriate, with lateral margins narrowly scarious near the apex, outer phyllaries ovate, inner phyllaries linear-elliptic, phyllary apices acute; corolla ca. 4 mm, 5-laciniate; anthers exserted; styles ca. 4.5 mm, style apex tumescent, bearing sweeping hairs, branches connivent; pappus uniseriate, ca. 4 mm; involucre of female capitula 4- or 5-seriate,

oblong, ca. 4.5–5 × 2.5–3 mm; florets 30 to 35; phyllaries light brown at the base and dark brown at the apex, dentition of phyllary margins fimbriate, with lateral margins narrowly scarious near the apex, outer phyllaries oblong-ovate, inner phyllaries linear-elliptic, phyllary apices acute; corolla ca. 2.5 mm, apex short-ligulate; styles 5 mm, style branches short, divergent. Cypselae oblong, straw-colored, ca. 1 mm, ca. 8-ribbed, with 2 ribs more conspicuous; pappus uniseriate, ca. 3.5 mm, not accrescent at maturity.

Distribution, habitat, and IUCN Red List category. *Baccharis ramboi* occurs in the southern Brazilian states of Santa Catarina and Rio Grande do Sul. It is found principally scattered in wetlands through the subtropical high-altitude grasslands of the Serra Geral, sympatrically to *B. pseudovillosa*, and in the subtropical seasonally wet lowlands found in adjacent areas near the southern edge of the Serra Geral highlands. Due to the lack of further information, it is not suitable to estimate the size of the overall plant population, but the potential area of occupancy of the species is being reduced by threats such as large-scale wood plantations of *Pinus* L., the alien invasive potential of *Pinus* seedlings, and by human disturbance resulting from government programs to colonize less-populated areas of the countryside. Taking into account the scarce knowledge available for the recently described species, we provide a preliminary conservation assessment of Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Etymology. *Baccharis ramboi* is named to honor the collector of the holotype specimen, the southern Brazilian botanist Balduíno Rambo S.J. (1905–1961).

Discussion. *Baccharis ramboi* most closely resembles *B. pseudovillosa* in its similar habit and sympatric habitat. However, *B. ramboi* differs from *B. pseudovillosa* mainly in its indument (hispid vs. villous), narrower stem wings (0.1–0.5 cm vs. 0.5–1 cm), oblong leaf blades (vs. ovate to triangular), leafy bracts (vs. scaly bracts), oblong involucres (vs. oblong-campanulate involucres), and short-ligulate (vs. dentate) corolla apex of female florets.

Paratypes. BRAZIL. **Rio Grande do Sul:** Montenegro, San Salvador, 2 Oct. 1975 (♂), *Friedrichs 32914* (RB 228712); Osório, Faz. do Arroio, 4 Jan. 1950, *B. Rambo S.J. s.n.* (PACA 45168), 6 Mar. 1950 (♂), *B. Rambo S.J. s.n.* (PACA 46135), 23 Jan. 1958 (♀), *B. Rambo S.J. s.n.* (PACA 63561); São Francisco de Paula, Jan. 1944 (♀), *P. Buck s.n.* (PACA 11632), Cambará, 5 Feb. 1948 (♀, ♂), *B. Rambo S.J. s.n.* (PACA 36249, RB 414977). **Santa Catarina:** Santa Cecília, Campo do Areião, 19 Dec. 1962 (♂), *Reitz 14180 & Klein* (RB 119353), Jan. 1964 (♂), *E. Pereira 8370 & G. Pabst 7645* (PEL 5740); Campo Alegre, 9 Nov. 1956 (♂), *L. B. Smith 7473* (RB 100961); São José, Serra da Boa Vista, 24 Jan. 1961 (♂), *R. Reitz 10707* (RB 122614).

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A New Species of *Dimeria* (Poaceae, Panicoideae, Andropogoneae) from Goa, India

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ABSTRACT. *Dimeria veldkampii* Kiran Raj & Sivadasan, from north Goa of the northern Western Ghats, is illustrated and described as a new species of Poaceae belonging to the subtribe Dimeriinae of the tribe Andropogoneae. The species resembles *D. woodrowii* Stapf, but differs mainly by its inflorescence rachises being singly or doubly circinately recurved and by the immediate shedding of the spikelets as diaspores. Comparative morphological features of the new species and *D. woodrowii* are described, and a dichotomous key to the constituent species of *Dimeria* sect. *Annulares* Bor is provided.

Key words: Andropogoneae, *Dimeria*, *Dimeria* sect. *Annulares*, Dimeriinae, Goa, India, IUCN Red List, Poaceae, tachychorous.

Dimeria R. Brown, a little known paleotropical genus of Poaceae, was first described by Robert Brown in 1810. It belongs to the monotypic subtribe Dimeriinae Hackel within the tribe Andropogoneae, subfamily Panicoideae. The genus is mainly distributed in tropical Asia, and ca. 40 species out of ca. 65 species in the world grow on the Indian subcontinent (Bor, 1953; Jain, 1986; Ravi et al., 2001). Clayton and Renvoize (1986) considered *Dimeria* as an enigmatic member of the tribe Andropogoneae due to its unique morphological characteristics such as the presence of a tough non-articulated rachis and the spikelets borne singly with no trace of pairing. Bor (1953) has published the only detailed taxonomic study of the genus.

The examination of specimens collected for a revision of peninsular Indian species of *Dimeria* revealed an interesting collection in northern Goa. After critical study, analysis, reference to relevant floristic works (Hooker, 1897; Fischer, 1934; Bor, 1960; Clayton, 1994; Moulik, 1997), and comparison with specimens of *Dimeria* available at different herbaria (CAL, MH, BSI, K), the novelty of the species became evident. Therefore, it is described here and an illustration is provided.

Dimeria veldkampii Kiran Raj & Sivadasan, sp. nov. TYPE: India. Goa: North Goa Distr., Taleigao, ca. 50 m, 27 Oct. 2002, *M. S. Kiran Raj 81073* (holotype, CALI; isotypes, MH, MO). Figure 1.

Dimeriae woodrowii Stapf similis, sed racemi pedunculo maturitate recto, rhachidi quiusque racemi laxius involuta, callo dense barbato ca. 0.3 mm longo, gluma superiore exalata vel distaliter secus cristam ala minuta praedita, lemmate superiore arista distincta 8–12 mm praedito, columna aristae 3–4.5 mm longa differt.

Annuals; culms up to 18 cm tall, erect or decumbent at the base, simple, smooth, glabrous; nodes sometimes hairy; internodes shorter than the sheaths. Leaves usually all along the culm; sheaths very loose, longer than the internodes, smooth and glabrous, striate, hyaline on the margins, the uppermost spathe-like and subtending the inflorescence; blades linear, acuminate, 3–6 cm × 1–2.5 mm, rather thick, with a broad midrib, ca. 0.4 mm wide, with scattered bulbous-based white hairs on the adaxial surface toward the base or glabrous, minutely scabrid adaxially, smooth or very minutely scabrid on the margins, tapering to aristate tip; ligules membranous, ciliate, 1–1.5 mm. Inflorescence straight, consisting of a peduncle exserted from a spathe-like sheath, carrying at the tip 2 racemes each of which consists of a flat, tough rachis, initially straight with the spikelets adaxially arranged; each raceme circinately curved or incurved at maturity and drying, each forming a "ringlet" with the spikelets on the inner surface; rachis smooth and glabrous, angled adaxially and convex dorsally. Spikelets pedicellate, oblong-lanceolate, 4.5–5 mm; pedicel stout, ca. 0.5 mm, glabrous; callus cuneate, ca. 0.3 mm, densely bearded; lower glume ca. 4 mm, coriaceous, yellowish brown when dry, firmly compressed but rounded on the scabrid keel, oblong, obtuse when spread, straight on the back, glabrous or with a few hairs on the sides; upper glume 4.5–5 mm, firmly compressed, coriaceous, becoming hyaline on the margins, keeled throughout, oblong, obtuse when spread, sparsely hairy and wingless or minutely winged along the keel toward apex; lower floret empty; lemma a hyaline, oblanceolate scale, 2–2.5 mm; upper floret complete, bisexual; lemma ca. 2.5 mm, oblong, acute, shortly cleft at

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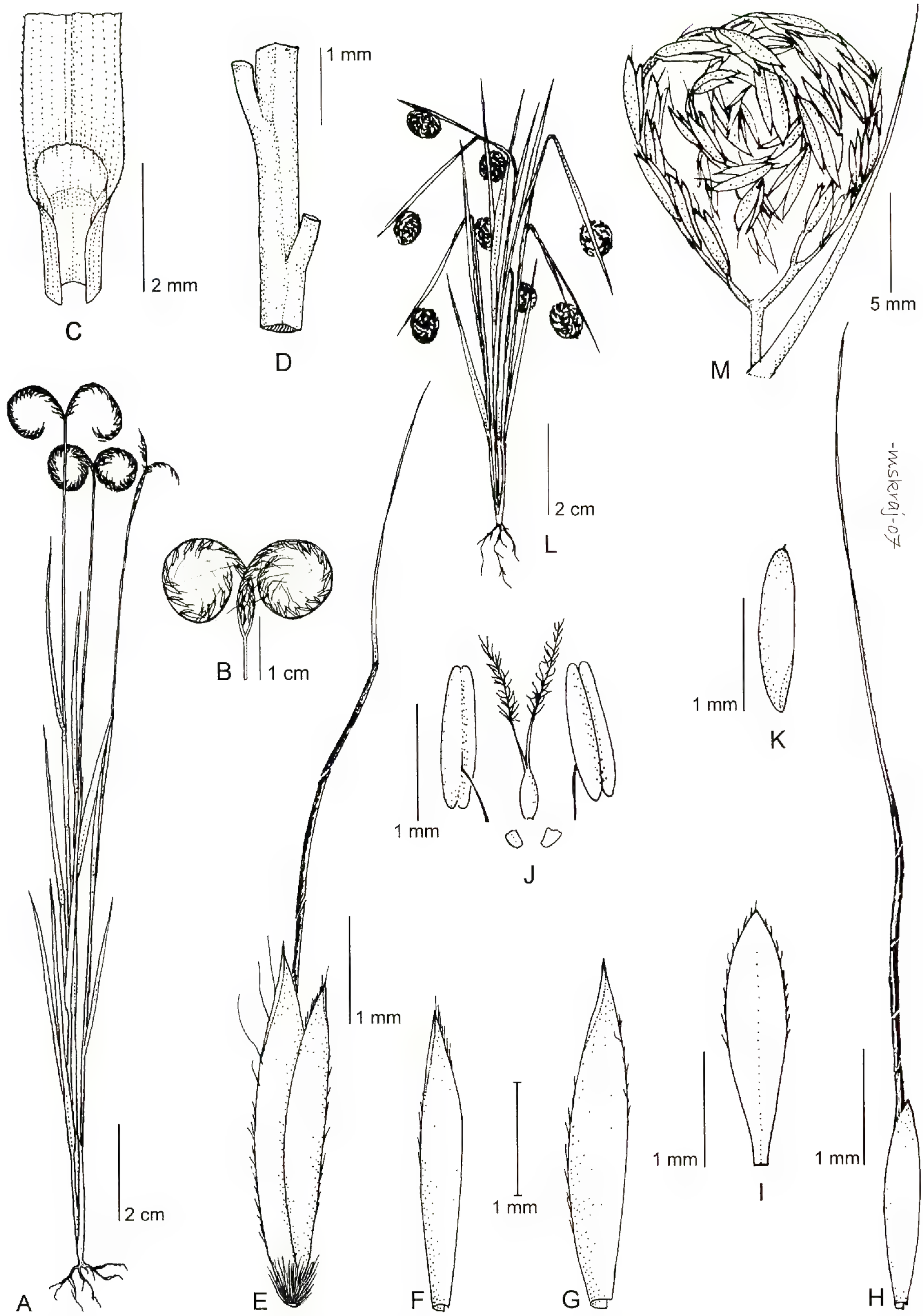

Figure 1. A–K. *Dimeria veldkampii* Kiran Raj & Sivadasan. —A. Habit with inflorescence forming ringlets. —B. Raceme-ringlet enlarged. —C. Junction of leaf-sheath and lamina showing ligule. —D. Portion of rachis with pedicels. —E. Spikelet. —F. Lower glume. —G. Upper glume. —H. Upper lemma with awn. —I. Lower lemma. —J. Lodicules, stamens, and pistil. —K. Grain. L, M. *D. woodrowii* Stapf. —L. Habit with inflorescence forming globules. —M. Raceme-globule enlarged. A–K drawn from the holotype, *M. S. Kiran Raj 81073* (CALI); L, M drawn from *M. S. Kiran Raj 81020* (CALI).

Table 1. Comparison of diagnostic features of *Dimeria woodrowii* and *D. veldkampii*.

	D. woodrowii	*D. veldkampii*
Culms and peduncles	culm straight; peduncle bent downward at maturity	culm sometimes decumbent at the base; peduncle straight
Racemes	2 or 3; tightly rolled together forming a raceme globule	2, loosely rolled separately forming single or double ringlets
Raceme group	articulated with the peduncle, enclosed in spathe-like sheath at maturity	not articulated with the peduncle, not enclosed in the sheath
Callus	ca. 0.1 mm, inconspicuous, sparsely bearded	ca. 0.3 mm, densely bearded
Spikelets	subcrustaceous, acute at apex, reddish brown when dry	coriaceous, acuminate to aristate at apex, yellowish brown when dry
Glumes	dorsally rounded at the base and keeled at apex, hairy along the sides below	dorsally keeled throughout, hairy toward keeled apex
Upper glumes	with a broad wing at the apex	with or without a minute wing at apex
Awns	awn of lemma without a basal column	awn of lemma with a well-differentiated basal column
Disarticulation of spikelets	tardy disarticulation of spikelets from the diaspore and dispersal, hence bradychorous	early disarticulation of the spikelets from the diaspore and dispersal, hence tachychorous

apex, with a strong midrib continued as a definite awn of ca. 8–12 mm, column well differentiated, 3–4.5 mm; palea absent; lodicules 2, small, ca. 0.3 mm, truncate, apically toothed; stamens 2, anther ca. 1 mm; styles 2, distinct; stigmas plumose. Grain ca. 1.5 mm, laterally compressed, clavate; embryo 1/2 as long as the grain; hilum basal, small.

Distribution. *Dimeria veldkampii* is known only from Goa in the northern Western Ghats, India.

Habitat and ecology. The new species was found on grassy plains of dry lateritic plateau at altitudes ca. 50 m above sea level, and was observed as growing during the South-West monsoon period in India.

IUCN Red List category. *Dimeria veldkampii* is endemic to North Goa District, in the northern region of the Western Ghats. The species is apparently rare and restricted in distribution and is known only from one population within an area of 100 km^2 in the type locality. Hence, we assign Endangered (EN) status to the species based on the preliminary assessment as per the IUCN Red List criteria (IUCN, 2001).

Phenology. Observed as flowering and fruiting from October to December.

Etymology. The new species is named in honour of J. F. Veldkamp (National Herbarium of the Netherlands, University of Leiden, The Netherlands), a world-renowned agrostologist who made valuable contributions during the authors' study of the genus *Dimeria*.

Discussion. In raceme morphology, *Dimeria veldkampii* closely resembles *D. woodrowii*, an endemic species of peninsular India, but differs from it by its exserted, non-articulated peduncle, and the loosely incurved raceme-rachis. The comparative diagnostic characters of *D. veldkampii* and *D. woodrowii* are given in Table 1.

Several of the characters of the new species are similar to those of *Dimeria* sect. *Annulares* Bor, and this is where we suggest it belongs. The section previously contained a single species (viz. *D. woodrowii* Stapf) and is characterized by the circinate curving of the rachises, a phenomenon not observed in any other species of the genus. In *D. veldkampii* and *D. woodrowii*, the rachises at first circinately curve or incurve, and finally form a ringlet (Fig. 1B) and a globule shape (Fig. 1M) in the former and latter taxon, respectively. Bor (1953: 592) used the term "hoop" for the globular mass of racemes formed in the case of *D. woodrowii*, but detailed observation and study have revealed the inappropriateness of the term for the structure that is spherical in shape. At maturity, these rolled racemes that form ringlets and globules fall and function as individual conjoined diaspores. The diaspores roll over the lateritic plateau blown by wind and are deposited in soil-filled crevices where the seeds germinate during favorable climatic conditions. This kind of dispersal mechanism—"anemogeochory" as termed by van der Pijl (1972: 58)—is unique and effective in the spread of the species on dry lateritic grassy plains (pers. obs.). In *D. woodrowii*, there is a delay before the spikelets disarticulate and hence the dispersal is termed as bradychorous (Thanos, 2004). The term "bradychory" was first coined by Dixon (1933) and not by Thanos (2004). In the case of *D. veldkampii*, the spikelet disarticulation occurs immediately after the shedding of the diaspores from the plant and hence effects early dispersal, which is termed as tachychorous (Dixon, 1933).

Paratype. INDIA. **Goa:** North Goa Distr., Goa University Campus, > 50 m, 23 Dec. 2002, *M. S. Kiran Raj 92987* (CALI).

KEY TO THE SPECIES OF *DIMERIA* SECT. *ANNULARES*

1a. Peduncle bending downward at maturity; rachis tightly rolled; raceme globule shed with the peduncle along with spathe-like sheath; awn-column absent; glumes distinctly winged at apex . . . . . *D. woodrowii*

1b. Peduncle straight; rachis loosely rolled; raceme ringlet shed without the peduncle; awn-column present; glumes wingless or minutely winged at apex . . . . . *D. veldkampii*

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Cyperus limiticola, a New Name for a Madagascan *Cyperus* (Cyperaceae)

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ABSTRACT. There is a need to propose a new name in *Cyperus* L. for *C. paucispiculatus* Chermezon because the name currently used is an illegitimate later homonym of *C. paucispiculatus* Böckeler. A new name, *C. limiticola* Larridon & Reynders, is provided here.

Key words: Cyperaceae, *Cyperus*.

In 1884, Böckeler described *Cyperus paucispiculatus* Böckeler [= *Pycreus divulsus* (Ridley) C. B. Clarke]. Chermezon (1919) used *C. paucispiculatus* Chermezon for a new species from Madagascar and placed it in its own section, *Cyperus* sect. *Paucispiculati* Chermezon. The latter species does not belong to the genus *Pycreus* P. Beauvois, and so is not related to *P. divulsus*, although both species show a reduction in the number of spikelets. *Cyperus paucispiculatus* Chermezon is a later homonym of *C. paucispiculatus* Böckeler and is therefore illegitimate (McNeill et al., 2006: Art. 53.1). A new name, *C. limiticola* Larridon & Reynders, is proposed. The epithet, which means "inhabiting the edge," refers to the natural surroundings in which the plant was collected (i.e., the edge of the forest).

Cyperus limiticola Larridon & Reynders, nom. nov. Replaced name: *Cyperus paucispiculatus* Chermezon, Bull. Soc. Bot. France 66: 342. 1919 [1920], non *Cyperus paucispiculatus* Böckeler, 1884. TYPE: Madagascar. [Antananarivo]: Distr. Manjakandriana, lisière de la forêt à l'Est d'Ambatolaona, 1400 m, 11 Nov. 1912, *R. Viguier & J.-H. Humbert 1256* (holotype, P 00450832; isotypes, P 00450833, P 00581793). Figure 1.

Caespitose perennial herb with a slender rhizome; culms filiform, 15–35 cm × ca. 0.5 mm, smooth. Leaves few, slightly shorter than the culms, ca. 0.5 mm wide, setaceous, semicylindrical, smooth, leaf sheaths fuscous. Lower involucral bract smooth, erect, continuing in the direction of the culm, up to 3–6 cm, setaceous; second involucral bract glumiform; anthela composed of 1 to 3 radii; radii 0–4 cm, erect, with short prophylls and 1 or 2 spikelets; spikelets compressed, ovate-lanceolate, ca. 5 × 2.5 mm, with 5 to 7 flowers; rachilla winged. Glumes slightly imbricate, ovate-lanceolate, shortly mucronate, ca. 3 mm, subrigid, the sides yellow-brown, with 2 or 3 obscure lateral nerves, midrib narrow, smooth, green, 3-nerved; stamens 3; anthers linear, connectives shortly setiferous; style deeply trifid. Achenes immature.

Discussion. Chermezon (1919) stated that, with its multinervate glumes and its setiferous anthers, this isolated species only approaches the sections *Cyperus* sect. *Diffusi* (Kunth) C. B. Clarke and *Cyperus* sect. *Debilissimi* Chermezon, from which it is, however, sufficiently distinct, by its inflorescence and its leaves, to deserve its own section. Molecular research may offer an answer to its taxonomic relationships, although sadly this species is only known from its immature type specimens.

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Figure 1. *Cyperus limiticola* Larridon & Reynders. —A. Habit. —B. Inflorescence. —C. Detail of spikelets. Drawn by Marc Reynders from the holotype *Viguier & Humbert 1256* (P).

Especie Nueva de *Croton* sección *Eluteria* (Euphorbiaceae) de Chiapas, México

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Resumen. Se describe e ilustra *Croton carpostellatus* B. L. León & Martínez-Gordillo, especie nueva de Chiapas, México. Esta especie es afín a *C. schiedeanus* Schlechtendal y pertenece a *Croton* L. sección *Eluteria* Grisebach, de la cual difiere por presentar ovario y cápsula con tricomas estrellados. Se presenta una clave para distinguirla de los taxa cercanos y una ilustración de la especie.

Abstract. *Croton carpostellatus* B. L. León & Martínez-Gordillo, a new species from Chiapas, Mexico, is described and illustrated. This new species belongs to *Croton* L. sect. *Eluteria* Grisebach, and it appears similar to *C. schiedeanus* Schlechtendal, although it differs in its ovary and capsule with stellate trichomes. A dichotomous key for distinguishing closely related taxa is included.

Key words: Chiapas, *Croton*, *Eluteria*, Euphorbiaceae, IUCN Red List, Mexico.

El género *Croton* L. es muy diverso dentro de la familia Euphorbiaceae. En la clasificación infragenérica de Webster (1993) se reconocen 40 secciones. La sección *Eluteria* Grisebach es una sección endémica del continente americano que se distingue fácilmente porque en México, es la única que presenta flores pistiladas con pétalos bien desarrollados, además del indumento generalmente lepidoto y las inflorescencias axilares. Presenta 12 especies, 10 de las cuales se encuentran en la República Mexicana.

En un recorrido de colecta por el estado de Chiapas se detectaron ejemplares pertenecientes a *Croton* sección *Eluteria*, que al ser examinados llevaron a la conclusión que presentan una combinación de caracteres diferente a la de especies conocidas hasta el momento, así que se propone como una especie nueva para la ciencia.

Croton carpostellatus B. L. León & Martínez-Gordillo, sp. nov. TIPO: México. Chiapas: Mun. Chilón, Pamalhá, 17°13′N, 92°06′W, 26 abr. 2005, *B. León 144* (holotipo, CIQR; isotipos, DAV, FCME, MEXU, MO, OAX, WIS). Figura 1.

Arbor 6 m alta. Folia lanceolata, in apice longe acuminata, in margine integra; stipulis subulatis, caducis. Inflorescentia 2.5–4 cm longa. Stamina (8)9 ad 10; *Crotoni schiedeanae* Schlechtendal affinis, sed ovariis stellato-tomentosis distinguenda.

Árboles de aproximadamente 6 m de alto, monoicos, tronco 10 cm diámetro, savia poco abundante, coloreada. Hojas 11.4–26 × 3.7–10.8 cm, ovado-lanceoladas a lanceoladas; ápice largo-acuminado, margen entero, base estrechamente cordada, 3 a 5 nervios a la base; nervadura pinnada, 9 a 10 pares de nervios laterales; haz glabrescente, envés densamente lepidoto; pecíolo 2.2–6 cm, lepidoto; estípulas 1–1.5 mm, subuladas, caducas. Inflorescencias 2.5–4 cm; axilares; brácteas de 1.4 mm; bractéolas 0.5–1 mm, linear-subuladas, cara adaxial glabra, cara abaxial pubescente, margen ciliado. Flores estaminadas pediceladas, pedicelo 1–6 mm, sépalos 1.5–2 mm, lanceolados, unidos sólo a la base, cara adaxial glabra, cara abaxial lepidota, margen ciliado; pétalos ca. 2 × 0.7 mm, oblongos, cara adaxial y abaxial glabras, margen ciliado, glándulas impresas presentes; estambres (8)9 a 10, filamentos glabros, antera cordiforme, conectivo glandular. Flores pistiladas pediceladas, pedicelo 3–4 mm, sépalos ca. 2.8 × 1.5 mm, lanceolados, cara adaxial glabrescente, cara abaxial lepidota; pétalos oblongos de ca. 3 × 1 mm, cara abaxial glabrescente, cara adaxial con pelos cortos, margen ciliado; ovario esférico, estrellado-tomentoso, estilos 3(4) veces bifurcados, con tricomas muy escasos, unidos sólo en una tercera parte de su longitud. Fruto, una cápsula 10 mm diámetro, esférica, cubierta de tricomas estrellados porrectos, tomentosa; semillas ca. 6.5 × 4 mm, elipsoides, marrones, lisas; carúncula pequeña, amarilla.

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Figura 1. *Croton carpostellatus* B. L. León & Martínez-Gordillo. —A. Rama mostrando botones. —B. Inflorescencia con flores estaminadas distales y flores pistiladas proximales. —C. Flor estaminada. —D. Fruto mostrando semillas. —E. Tricoma foliar lepidoto. —F. Tricoma estrellado del fruto. Dibujo basado en el isotipo *B. León 144* (FCME).

Distribución y hábitat. Hasta el momento sólo se ha encontrado en Pamalhá, municipio de Chilón, Chiapas, el sitio se localiza en la Sierra de Chiapas al nordeste de San Cristóbal de las Casas, en sitios con bosque tropical perennifolio, con rocas sedimentarias y vulcano-sedimentarias del Eoceno y del Cretáceo superior mezcladas con limonita, areniscas y calizas, con una pequeña parte con suelos del Cuaternario. Es

una zona con precipitación media anual de 3000–3500 mm y una temperatura media anual de 24°C–26°C (www.inegi.gob.mx).

Estado de conservación. Aun no se tiene un estudio detallado sobre el estado de riesgo de esta especie, por lo que se le declara como "Not Evaluated" (NE) de acuerdo al IUCN Red List (IUCN, 2001). Sólo se puede mencionar que es una especie abundante en sitios perturbados.

Fenología. Se colectó en abril con frutos y en junio con inflorescencias masculinas.

Etimología. El nombre específico hace referencia al fruto con tricomas estrellados, una característica no común de esta sección.

Discusión. Esta especie se localiza en bosque tropical perennifolio, un tipo de vegetación donde no es común encontrar especies de este género en México, sólo se conocen 15 especies de *Croton* en este tipo de vegetación (Martínez et al., 2002). Se trata de un árbol, una forma biológica también poco frecuente en *Croton* del país, ya que sólo 16 la presentan (Martínez & Cruz, 2002). Es una especie perteneciente a *Croton* sección *Eluteria*, que tiene aproximadamente 10 a 12 especies (Webster, 1993) y se distingue por presentar pétalos bien desarrollados en las flores pistiladas y generalmente indumento lepidoto, que muy frecuentemente les da un aspecto argénteo. Dentro de la sección se encuentran especies con hojas de nervadura pinnada o palmada, dentro de las primeras se encuentra *C. carpostellatus*, que se distingue principalmente por presentar el ovario y la cápsula cubiertos de tricomas estrellados en vez de escamosos. *Croton carpostellatus* tiene gran parecido a *C. schiedeanus*, sin embargo, se distingue por el ovario estrellado-tomentoso y liso, características que no se han visto en las distintas poblaciones de *C. schiedeanus*. A continuación se provee de una clave para separarla de las especies relacionadas.

Paratipo. MÉXICO. **Chiapas:** Mun. Chilón, Pamalhá, *B. L. León 145* (FCME).

Clave para Diferenciar a *Croton carpostellatus* de las Especies de la sección *Eluteria* con Nervadura Pinnada de México

1a. Ovario estrellado-tomentoso; tricomas del fruto con un radio generalmente porrecto; cápsula lisa. . . . . *C. carpostellatus*

1b. Ovario lepidoto; tricomas del fruto sin un radio porrecto; cápsula muricada o submuricada.

2a. Filamentos glabros; cápsula muricada, pedicelo de las flores pistiladas 1–2.5 cm de largo. . . . . *C. schiedeanus*

2b. Filamentos vellosos, al menos en la mitad inferior; cápsula submuricada; pedicelo de las flores pistiladas de menos de 1 cm de largo.

3a. Hojas lanceoladas u lanceolado-oblongas; pétalos de la flor estaminada oblanceolados . . . . . *C. icche* Lundell

3b. Hojas lanceolado-ovadas; pétalos de la flor estaminada espatulados. . . . . *C. nitens* Swartz

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Rosa carolina (Rosaceae) Subspecies and Hybrids in Eastern and Midwestern United States, Canada, and Mexico

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Abstract. Three subspecies of *Rosa carolina* L. (Rosaceae) are recognized in eastern Canada, the United States, and Mexico, including one change in combination and status and a new subspecies, respectively: *R. carolina* subsp. *subserrulata* (Rydberg) W. H. Lewis and *R. carolina* subsp. *mexicoensis* W. H. Lewis. *Rosa carolina* subsp. *subserrulata* occurs commonly in the western range of the species centered in the Ozark Plateau and adjacent areas, north in the midwestern United States to eastern Lake Superior in Canada, and infrequently to the eastern ranges of the Appalachian and Allegheny Mountains, while *R. carolina* subsp. *mexicoensis* is a southern disjunct subspecies of the Sierra Madre Oriental in northeastern Mexico. Two nothospecies are described for putative hybrids: *R.* ×*mediоccidentis* W. H. Lewis is recognized between *R. carolina* and *R. arkansana* Porter in the midwestern United States, and *R.* ×*novae-angliae* W. H. Lewis between *R. carolina* and *R. virginiana* Miller in the eastern United States region of New England. Synonyms are provided for appropriate subspecies and hybrids. Two lectotypes are designated here, and representative exsiccatae or paratypes are given for the new subspecies and nothospecies. The following names are lectotypified: *R. rudiuscula* Greene and *R. serrulata* Rafinesque.

Key words: Canada, IUCN Red List, Mexico, *Rosa*, Rosaceae, United States.

Rosa carolina L., Carolina or pasture rose, is the most widely distributed and variable species of *Rosa* L. (Rosaceae) in eastern North America, as *R. woodsii* Lindley and *R. nutkana* C. Presl are in more western parts of the continent (Lewis & Ertter, 2007). Its diversity is particularly evident between eastern and midwestern populations from east to west in the United States and to a limited extent in Canada. *Rosa carolina* subsp. *carolina* is centered primarily in the east from Maine to northern Florida and west to parts of Michigan, Indiana, Kentucky, Tennessee, and Mississippi as the dominant subspecies. The subspecies also occurs sporadically in the Midwest and in southern parts of eastern Canada from Ontario to New Brunswick. In the Midwest from Wisconsin and parts of Michigan and Indiana south to Illinois, Iowa, Missouri, Arkansas, Louisiana, Kansas, Oklahoma, and Texas, *R. carolina* subsp. *subserrulata* (Rydberg) W. H. Lewis predominates. This is particularly evident in the central and western Ozark Plateau of Missouri and Arkansas and adjacent states. In the eastern Appalachian and Allegheny Mountains of Pennsylvania, West Virginia, Virginia, and Maryland, sporadic populations of *R. carolina* subsp. *subserrulata* are also found at higher elevations, particularly in dry rocky habitats. Here and elsewhere where ranges of these subspecies overlap, habitats of subspecies *subserrulata* are usually drier and rockier, with limited soil, compared to those of subspecies *carolina*.

Rosa carolina is included in the Carolina province of eastern North America, which McLaughlin (2007) divides into two major subprovinces with Austroriparian in the south to northeast and Illinoian in the Midwest, corresponding by and large to ranges of subspecies *carolina* and subspecies *subserrulata*, respectively, with a smaller Appalachian subprovince in the east where both subspecies are occasionally found.

The following synopsis of *Rosa carolina* consists of a key to subspecies, synonymy, and paratypes or exsiccatae.

1. Rosa carolina L., Sp. Pl. 492. 1753, non *Rosa carolina* L., 1762. TYPE: Dillenius figure, pl. 245, f. 316, Hort. Elth. 325. 1732.

Key to the Subspecies of *Rosa carolina* in Eastern North America and Mexico

1a. Fertile branches armed with straight, thin or rarely stout, circular or somewhat flattened infrastipular prickles lacking internodal prickles or aciculi or if present few and scattered; stems mostly thin, pendent or upright; hypanthia (later hips) and pedicels stipitate-glandular, rarely eglandular; typically eastern United States, southeastern Canada, and northeastern Mexico 2

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2a. Shrubs (0.2–)3–1(–1.3) m tall; upper stem internodes (10–)20–40 mm long; leaves 5.5–16 cm long, terminal leaflets 18–40(–50) × 9–28 mm, margins typically single serrated and eglandular, infrequently biserrated or multiserrated and gland-tipped, rachis/petioles and stipule margins either eglandular or stipitate-glandular; typically eastern United States and sporadically to the west, and southeastern Canada . . . . . subsp. *carolina*

2b. Subshrubs (0.1–)0.2–0.4(–0.6) m tall, densely branched; upper stem internodes 10–20 mm long; leaves 3.5–6.5 cm long, terminal leaflets 11–17(–32) × 5–10(–13) mm, margins consistently biserrated or multiserrated and gland-tipped, rachis/petioles and stipule margins densely stipitate-glandular; northeastern Mexico . . . . . .subsp. *mexicoensis*

1b. Fertile branches armed with straight, thin or often stout, circular or flattened infrastipular prickles with internodal prickles of small prickles, aciculi, and stipitate glands, usually densely covering branches and adjacent stems; stems mostly thick, upright; hypanthia (later hips) and pedicels stipitate-glandular or eglandular; predominant in the midwestern United States, infrequent to mountainous areas of eastern United States, rare in Canada . . . . . .subsp. *subserrulata*

1a. Rosa carolina L. subsp. **carolina.** Figure 1A.

Rosa aucuparia Rydberg, N. Amer. Fl. 22: 501. 1918. Syn. nov. TYPE: U.S.A. Missouri: Clark Co., Dumas [as "Dumal"], dry banks, 6 July 1909, *B. F. Bush 5866* (holotype, NY; isotype, MO 1799003).

Rosa caroliniana Michaux, Fl. Bor.-Amer. 1: 295. 1803. TYPE: U.S.A. "Georgia and Carolina": s.d., *A. Michaux s.n.* (holotype, P-MICH).

Rosa petiolata Rydberg, N. Amer. Fl. 22: 501. 1918. Syn. nov. TYPE: U.S.A. Missouri: Clark Co., 27 Aug. 1892, *B. F. Bush s.n.* (holotype, MO 1799002; isotype, MO 5255454).

Rosa serrulata Rafinesque, Ann. Gén. Sci. Phys. 5: 218. 1820. Syn. nov. TYPE: U.S.A., s.d., *C. S. Rafinesque s.n.* (lectotype, designated here, P 511826).

Rosa treleasei Rydberg, N. Amer. Fl. 22: 503. 1918. Syn. nov. TYPE: Louisiana: Bossier Par., Alden(s) Bridge, 30 June 1898, *W. Trelease s.n.* (holotype, MO 1931631; isotypes, MO 1931630, NO, NY 429914 [fragm.]).

Although synonyms of *Rosa carolina* subsp. *carolina*, the types of *R. lyonii* Pursh (Fl. Amer. Sept. 1: 345. 1814; Tennessee: July, *J. Lyon s.n.*), *R. humilis* Marshall (Arbust. Amer. 1: 136. 1785), and *R. parviflora* Ehrhart (Beitr. 4: 21. 1789; "Carolina") remain unknown.

In his protologue, Rafinesque provided no location for *Rosa serrulata*, while Rydberg (1918: 500) stated that the type locality of *R. serrulata* was in the Highlands and Catskills of New York. Although finding no evidence to support this statement, I located two sheets at P bearing Rafinesque's handwriting of "*Rosa*" on the lower left sides and printed labels on the right sides bearing "Herb. Mus. Paris" and "C. S. Rafinesque." One sheet now determined as *R. carolina* subsp. *carolina* includes "États-Unis" on the label, and, as it closely matches Rafinesque's description of *R. serrulata*, it is selected as lectotype. The second sheet, also *R. carolina* subsp. *carolina*, is provided with a more specific locality, "Mts. Apalaches" (Appalachian Mountains), a locality not cited for any of his numerous newly described *Rosa* taxa.

The unpublished name *Rosa mackenziana* (or *mackenzieana*) was applied to collections widely distributed by B. F. Bush from Missouri: Clark Co., Dumas, rocky woods, 30 Aug. 1921, *Bush 9562 & 9563* (MO), and Jackson Co., Greenwood, oak woods, 3 Oct. 1923, *Bush 10217 & 10217A* (MO), and Kansas City, Swope Park, rocky woods, 7 June 1926, *Bush 10505* (MO, US). This is a variant of *R. carolina* subsp. *carolina* with few scattered aciculi among limited infrastipular prickles. These collections are morphologically similar to *R. aucuparia* in synonymy above.

1b. Rosa carolina subsp. **mexicoensis** W. H. Lewis, subsp. nov. TYPE: Mexico. Nuevo León: Sierra Madre Oriental, above Monterey, shaded slopes, 3000 ft. [984 m], 27 Aug. 1903, *C. G. Pringle 8736* (holotype, MEXU; isotypes, A, BH, BM, GH, K, MICH 1185414, MO 83764, NY, P 511832 & 511833). Figure 1B.

Rosa mexicana S. Watson, Proc. Amer. Acad. Arts 17: 354. 1882, nom. illeg., non *Rosa mexicana* Willdenow ex Crépin, 1872. TYPE: Mexico. Coahuila: Caracol Mtns., 21 mi. SE of Monclova, Aug. 1880, *E. J. Palmer 2124* (holotype, GH 102932; isotypes, BR, K).

A *Rosa carolina* typica fruticulo ramosissimo 0.2–0.4 m alto, internodiis caulinis tantum 10–20 mm longis, foliis 3.5–6.5 cm longis, foliolis multiserratis in apice glanduliferis et marginibus petiolorum differt.

Subspecies *mexicoensis*, a subshrub, differs from subspecies *carolina* by having stems only 0.2–0.4 m tall and more densely branched, upper stems with internodes only 10–20 mm long; leaves 3.5–6.5 cm long, leaflets with margins consistently biserrate or multiserrate and gland-tipped, and margins of petioles, rachises, and stipules densely stipitate-glandular.

Distribution, habitat, phenology, and IUCN Red List category. *Rosa carolina* subsp. *mexicoensis* flowers late April to early July, fruiting June to August, and grows on hillsides, shaded slopes, meadows, dense and open oak woods, and crests of ranges at elevations of ca. 800–1900 m in the Sierra Madre Oriental and associated mountains in the northeastern Mexican states of Nuevo León, Tamaulipas, and occasionally Coahuila. Subspecies *mexicoensis* is disjunct by ca. 200 miles from the nearest populations of *R. carolina* to the northeast in the

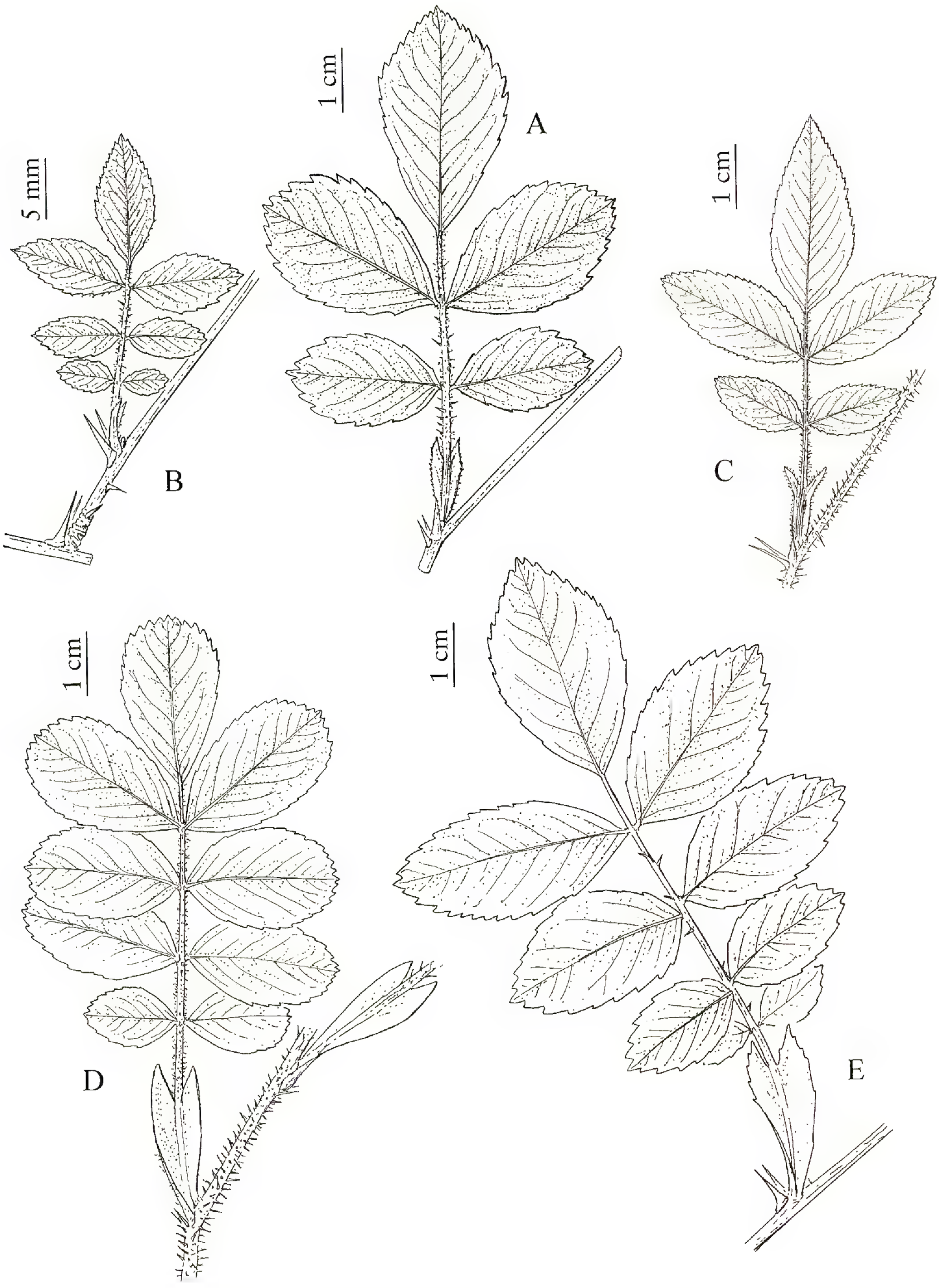

Figure 1. *Rosa* fertile branches from main stems: branches with prickles and/or aciculi, leaves with leaflets and stipules. —A. *R. carolina* L. subsp. *carolina*; drawn from *Lewis 2090* (MO). —B. *R. carolina* subsp. *mexicoensis* W. H. Lewis; drawn from *Bartlett 10265* (MICH). —C. *R. carolina* subsp. *subserrulata* (Rydberg) W. H. Lewis; drawn from *Bush 42* (NY). —D. *R. arkansana* Porter; drawn from *Lunell s.n.* (MO). —E. *R. virginiana* Miller; drawn from *Lewis & Elvin-Lewis 15765* (MO). A–E Drawn by J. Myers; used with permission of the Flora of North America Association.

United States. Regarding an IUCN conservation assessment of subspecies *mexicoensis*, so little is known that the category Data Deficient (DD) is most applicable.

Etymology. The subspecific epithet "*mexicoensis*" was chosen in recognition of its Mexican endemism and to avoid confusion with the illegitimate *Rosa mexicana* S. Watson. Both names refer to the same rose but apply at different ranks.

Discussion. *Rosa mexicana* is a later homonym. *Rosa mexicana* of Crépin (1872: 82) was used earlier to describe the European *R. canina* L. introduced to Mexico, which had already been named *R. montezumae* Humboldt & Bonpland ex Thory in Redouté (1817) based on *Humboldt & Bonpland 4076* (P). In his 1882 protologue, Watson correctly allied his *R. mexicana* with *R. parviflora* Ehrhart, which is referred to *R. carolina* subsp. *carolina*.

Paratypes. MEXICO. **Nuevo León**: Sierra Madre Oriental, near Monterey, Diente Canyon, *C. H. Mueller & M. T. Mueller 540* (F); Sierra Madre Oriental, ca. 15 mi. SW of Galeana, canyon above Alamar, *C. H. Mueller & M. T. Mueller 677* (F, MICH, NY, TEX); Sierra Madre Oriental, Taray to Río Santa Ana, Pabilillo, SE of Galeana, *F. W. Pennell 17158* (US); Dulces Nombres just E into Tamaulipas, *F. G. Meyer & D. J. Rogers 2719* (BM, K, MEXU, MICH, MO); Sierra Madre Oriental, near Monterey, *C. G. Pringle 2105* (A, MEXU, MO, NY); Sierra Madre Oriental, above Monterey, *C. G. Pringle 10175* (BH, BM, GH, K, MEXU, MICH, MO, NY, P). **Tamaulipas**: Gomez Farias Region, betw. Rancho del Cielo & Charco de los Perros, spring 1965, *Webster 147* (TEX); Sierra de San Carlos, Mesa de Tierra, vic. of San José, *H. H. Bartlett 10265* (MICH); Cerro Carrizo, vic. of San José, *H. H. Bartlett 10496* (MICH).

1c. Rosa carolina subsp. **subserrulata** (Rydberg) W. H. Lewis, comb. et stat. nov. Basionym: *Rosa subserrulata* Rydberg, N. Amer. Fl. 22: 500. 1918. TYPE: U.S.A. Missouri: Taney Co., Swan [Township], common in woods, 2 June 1899, *B. F. Bush 42* (holotype, NY 429910; isotype, MO 5255457). Figure 1C.

Rosa palmeri Rydberg, N. Amer. Fl. 22: 502. 1918. Syn. nov. TYPE: U.S.A. Missouri: Jasper Co., Carthage, dry rocky prairies along railroad, 13 Aug. 1911, *E. J. Palmer 3438* [protologue as "3428"] (holotype, GH 32600; isotypes, BR, MO 708165, 708199, 761355).

Rosa rudiuscula Greene, Leafl. Bot. Observ. Crit. 2: 134. 1911. TYPE: U.S.A. Missouri: Jackson Co., Little Blue, common in rocky woods, 22 July 1896, *B. F. Bush 208* (lectotype, designated here, NDG 23617; isotypes, BR, MO 5255433, NY 415879 [fragm.], US 281174).

Rosa texarkana Rydberg, N. Amer. Fl. 22: 503. 1918. U.S.A. Arkansas: Miller Co., N of Texarkana, by railroad, 24 July 1896, *E. Eggert s.n.* (holotype, MO 1931628; isotypes, MO 1931629, NY 429913 [fragm.]).

Discussion. In the F. Crépin herbarium at BR is a strapped leather folder containing sheets of many *Rosa* collected by B. F. Bush and K. K. Mackenzie in 1896 from several localities in Jackson County, Missouri, including Bush Creek, Courtney, Dodson, Sheffield, Waldo Park, and Westport, together with one sheet obtained by Mackenzie in 1899 from adjacent Wyandotte County in Kansas, Rosedale (Kansas City). On the folder label, Crépin identified these collections as *R. humilis* var. *setigera* after crossing out an earlier determination of *R. arkansana* Porter, the specific epithet "*humilis*" being a synonym of *R. carolina*, while the ined. variety *setigera*, characterizing collections with dense prickly armature of floral stems and branches, is *R. carolina* subsp. *subserrulata*. Individual sheets therein were also determined as *R. arkansana*, but he only replaced each name with *R. humilis*. Material of *R. humilis* in other folders is typical of *R. carolina* subsp. *carolina*. Crépin's *R. humilis* var. *setigera* remains unpublished, but his in-depth understanding of North American roses is well illustrated by this separation of *R. carolina* into two major groups.

B. F. Bush further collected material in Jackson County, Missouri, by swamps at Buckner, which on labels he named *Rosa mackenzii* in recognition of fellow collector K. K. Mackenzie. These *Bush* collections at MO include those of 30 June 1932 (*12492* [2 sheets], *12499*, *12500*, *12501*, *12502* [2 sheets]) and 19 Aug. 1932 (*12551A & B*). All possess long, straight, infrastipular prickles, either singly or in pairs, together with numerous shorter prickles and aciculi somewhat below branch apices, and with stipitate-glandular hypanthia and pedicels. These collections and their widely dispersed duplicates represent *R. carolina* subsp. *subserrulata*.

Of four B. F. Bush collections cited in E. L. Greene's protologue, *B. F. Bush 208* is selected lectotype because Bush determined the NDG sheet *Rosa rudiuscula* and Rydberg (1918: 503) cited the type locality in northwestern Missouri, adding "more exactly supplied from the label: Little Blue, Jackson County." Syntypes are *B. F. Bush 160* (Jackson Co., Dodson, 26 July 1896, BR), *167* (Jackson Co., Independence, rocky woods, 1 Aug. 1896, BR), and *170* (Jackson Co., Raytown, sandy pastures, 23 June 1896, MO 3093951 & 5258256). Erlanson (1934: 251) considered *R. rudiuscula* of hybrid origin between *R. arkansana* and *R. carolina*, and her decision has generally been followed since that time. The lectotype, isolectotypes, and syntypes, however, having paired infrastipular prickles and scattered aciculi without *R. arkansana* characteristics, are *R. carolina* subsp. *subserrulata*.

Distribution and habitat. *Rosa carolina* subsp. *subserrulata* flowers from May to July, fruiting August to November, and grows on hillside thickets, dry wooded slopes, rocky and loess hills, upland oak woods, rocky limestone hills and bluffs, cherty upper slopes, sandstone glades and bluffs, and prairies at elevations of ca. 150–1000 m. Subspecies *subserrulata* predominates in the midwestern United States, with its distributional center in the Ozark Plateau where it is particularly common in Arkansas, Missouri, eastern Oklahoma, northeastern Texas, and eastern Kansas. Less frequently, the subspecies extends to Wisconsin, Michigan, Illinois, Indiana, and rarely north to eastern Lake Superior in Ontario, south to Kentucky, Tennessee, Louisiana, Mississippi, and to the eastern states, mostly in mountainous areas. The first collection listed below represents a new subspecific report for Canada.

Representative exsiccatae. CANADA. **Ontario**: Algoma Distr., Lake Superior, mouth of Montreal River, Twilight Cabins, *H. H. Bartlett & C. D. Richards 541* (MICH). U.S.A. **Arkansas**: Conway Co., Morrilton, rocky thickets, *D. Demaree 23075* (MO); Hot Springs Co., Magnet Cove, *D. Demaree 14995* (MO); Phillips Co., near Helena, Crowley's Ridge, *E. J. Palmer 25103* (MO); Polk Co., Rich Mtn., *D. Demaree 23190* (MO). **Illinois**: Jackson Co., Cedar Lake, *T. Heineke 3134* (MO); LaSalle Co., Ottawa, hillside thickets, 23 June 1933, *E. J. Palmer 40515* (MO). **Indiana**: Harrison Co., W of Stewart's Landing, *C. C. Deam 18754* (MO). **Kansas**: Cherokee Co., 11 mi. S of Columbus, 1.3 mi. N of Kansas/Oklahoma state line, 23 May 2003, *W. H. Lewis & M. Elvin-Lewis 15843* (MO); Linn Co., La Cygne, 38°20′43″N, 94°46′19″W, 5 Aug. 1954, *W. H. Lewis 2386* (MO 1805715, chromosome no., $n = 14$). **Kentucky**: Clark Co., 1.5 mi. NE of Indian Fields, black shale region, *M. E. Wharton 6164* (MO); Logan Co., Russelville, *E. J. Palmer 17743* (MO); Rowan Co., near Morehead, *C. F. Reed 7570* (MO). **Louisiana**: Natchitoches Par., Creston, *E. J. Palmer 9428* (MO). **Maryland**: Allegany Co., top of Martin Mtn., 1675 ft. (511 m), 14 June 1952, *C. F. Reed 28726-A* (MO). **Michigan**: Ingham Co., E. Lansing, *W. H. Lewis 2513* (MO); Washtenaw Co., Ann Arbor, Cascade Glen, 16 Aug. 1925, *E. W. Erlanson s.n.* (MO). **Mississippi**: Benton Co., A. & M. College, Apr. 1923, *L. E. Brumfield s.n.*, E. W. Erlanson garden no. 3168 (MO); Kemper Co., ca. 3.1 mi. W of Scooba, *M. B. Brooks & S. McDaniel 169* (MO). **Missouri**: Benton Co., Clantonville, *D. Demaree 6791* (US); Bollinger Co., near Loyd, *E. J. Palmer 34931* (MO); Christian Co., 2 mi. S of Saunders, cherty upper slopes of ravine, *J. A. Steyermark 23222* (MO); Clark Co., Medill, dry prairies, *B. F. Bush 9145 & 9145B* (MO); Dade Co., S of Bona Galde, sandstone glade bluff, *P. L. Redfearn Jr. 32677* (MO); Dent Co., Current River, 2 mi. from Shannon Co. line, cherty limestone slopes, *J. A. Steyermark 19416* (MO); Jackson Co., Greenwood, prairies, *B. F. Bush 10082* (MO); Newton Co., 4 mi. SW of Joplin, *E. J. Palmer 22903* (MO); Pettis Co., S of Thornleigh, upland cherty woods above limestone bluffs of Muddy Creek, *J. A. Steyermark 20361* (MO). **Oklahoma**: Ottawa Co., 1.4 mi. NW of Commerce, *W. H. Lewis & M. Elvin-Lewis 15845* (MO); LeFlore Co., ca. 5 mi. S of Big Cedar, Hwy. 159, *W. H. Lewis 9807* (MO). **Pennsylvania**: Blair Co., Allegheny Mtns., Altoona, 1 Nov. 1869, *G. Engelmann s.n.* (MO). **Tennessee**: Bradley Co., 3 mi. E of Cleveland, *W. H. Lewis 2083* (MO). **Texas**: Kerr Co., Bear Creek, *A. Heller 1687* (MO); Lamar Co., 5.1 mi. N of Paris, Hwy. 271, *W. H. Lewis & M. Elvin-Lewis 15981* (MO [2]). **Virginia**: Shenandoah Co., Massanutten Mtns., 3-Top Mtn., rd. N of Woodstock, *H. A. Allard 7764* (MO); Warren Co., Overlook, Shenandoah Valley, Shenandoah Natl. Park, *W. H. Lewis 2442* (MO). **West Virginia**: Grant Co., Allegheny Mtns., S of Maysville, *C. F. Reed 139967* (MO). **Wisconsin**: Juneau Co., near Mauston, open upland woods, *E. J. Palmer 28427* (MO).

Nothospecies

Rosa arkansana (Fig. 1D), *R. carolina* (Fig. 1A–C), and *R. virginiana* Miller (nom. cons. prop., Fig. 1E) are polymorphic tetraploid species with distinct evolutionary histories from ancestral diploids of eastern North America. To reconstruct these histories, the closest diploid haplotype ancestor for each allele of each polyploid individual was identified to determine which diploid species contributed to the polyploids (Joly et al., 2006). To summarize, Joly et al. (2006) found that *R. arkansana* evolved largely from the diploids *R. blanda* Aiton and *R. woodsii*, *R. carolina* from this grouping and also from the diploids *R. foliolosa* Nuttall in Torrey & A. Gray, *R. nitida* Willdenow, and *R. palustris* Marshall, while *R. virginiana* evolved exclusively from the latter group. These results suggest that of the three tetraploids *R. carolina* is the most polymorphic species, even without secondary hybridity, as evidenced by the subspecific morphological diversity recognized in this paper.

Sympatric distributions between *Rosa carolina* and *R. arkansana* occur in the Midwest and between *R. carolina* and *R. virginiana* in the East at both the western and eastern range limits, respectively, of *R. carolina*. Among these putative hybrids (Lewis, 1957; Joly et al., 2006: fig. 1; Joly & Bruneau, 2007), accumulation of variability undoubtedly continues as new hybridizations and introgressions occur among interbreeding and interfertile species (Erlanson, 1934; Fishbein & Lewis in Joly et al., 2006), thereby adding to the polymorphism each tetraploid already possesses via earlier polyploidization. Consequently, identification of specimens found in so-called hybrid zones is at best approximate and is clearly correlated with the morphological variability associated with both primary and secondary polymorphism within these hybrid complexes.

Rosa arkansana × *R. carolina*

Putative hybrids and their introgressants of *Rosa arkansana* × *R. carolina* occur in the midwestern United States (western Missouri, eastern Kansas, and Iowa) and may be best expressed as the nothospecies *R.* ×*mediоccidentis* (from "medi," mid or middle, and

"occidentis," West [Latin genitive singular]). Occasional intermediates can be expected in Wisconsin and Illinois, wherever these species are sympatric in mixed prairie farmlands and eastern woodlands of the Midwest, ecosystems involving great disturbances for more than a century.

2. Rosa ×mediоccidentis W. H. Lewis, nothosp. nov. [*Rosa arkansana* Porter × *R. carolina* L.]. TYPE: U.S.A. Missouri: Jackson Co., 0.5 mi. W of Kelly rd. & Kansas City line on Hwy. 150, open grassy meadow/prairie, 250 m, 22 May 2003, *W. H. Lewis & M. Elvin-Lewis 15835* (holotype, MO 4838221; isotype, MT).

Caules aculeis parvis rectis dispersis, foliolis 7 ad 9, foliolo terminali elliptico vel obovato, stipulis 3–5 mm, hypanthiis pedicellisque glandulis stipitatis paucis vel nullis, fructibus per florem vulgo 1 ad 3.

The most important characters useful for identifying the nothospecies *Rosa ×mediоccidentis* (common name, Midwest rose) include: prickles of fertile branches and stems (*R. carolina* infrastipular prickles occasionally with scattered internodal prickles/aciculi; *R. arkansana* only aciculi usually dense to apex); leaflet number seven to nine per leaf (*R. carolina* to seven; *R. arkansana* to nine [to 11]); terminal leaflet shape variable (*R. carolina* elliptic to narrowly elliptic-lanceolate, rarely ovate; *R. arkansana* obovate, occasionally elliptic); stipule width 3–5 mm (*R. carolina* narrow, 2–4 mm; *R. arkansana* broad, 4–7 mm); stipitate glands of hypanthia and pedicels absent or few and scattered (*R. carolina* typically glandular; *R. arkansana* eglandular); the current-year shoots flowering/fruiting (*R. carolina* occasionally; *R. arkansana* commonly); flower/fruit (hip) number per inflorescence variable (*R. carolina* typically one to three [to six]; *R. arkansana* either one to three or four to 10 or more forming corymbs). When using these characters, an equal or near equal representation of each species and/or intermediate state would strongly suggest hybridity. Such data obtained in a region where both parental species occur would add further evidence to that of morphology in identifying putative hybrids and their likely introgressants.

Paratypes. U.S.A. **Iowa**: Boone Co., Golfax Township, along Ft. Des railroad, 20 June 1933, *A. Hayden 11808* (MICH); Johnson Co., Iowa City, N side of railroad, 22 June 1932, *M. Dorland 84* (MO); Louisa Co., near Columbus, 24 June 1933, *E. J. Palmer 40548* (MO); Poweshiek Co., near Grinnell, Nov. 1922, *H. S. Conard s.n.* (MICH, MO). **Kansas**: Anderson Co., SW of Welda by Hwy. 169 to SW 900 rd., prairie, 1050 ft. [320 m], 22 May 2003, *W. H. Lewis & M. Elvin-Lewis 15839* (MO); Douglas Co., barrens, 3 Oct. 1934, *B. F. Bush 14266* (MO); Franklin Co., E Ottawa, grassy verge, 39°15′N 097°30′W, 900 ft. [275 m], 22 May 2003, *W. H. Lewis & M. Elvin-Lewis 15838* (MO, MT, UC); Miami Co., W entrance to Hillside Lake, 38°32′N 094°55′W, 300 m, 22 May 2003, *W. H. Lewis & M. Elvin-Lewis 15837* (MO). **Missouri**: Atchison Co., prairies, 30 Sep. 1938, *B. F. Bush 11983* (MO); Cherokee Co., Turck, roadside, 4 Aug. 1954, *W. H. Lewis 2377* (MO 1806158, chromosome no., $n = 14$); Harrison Co., Helton Prairie Natural Area, betw. Bethany & Princeton, 26 June 1994, *G. Yatskievych 94-156* (MO); Vernon Co., ca. 8 mi. W of Nevada, 1.9 mi. N of jct. Hwys. 54 & H, 0.5 mi. E on first gravel rd., 900 ft. [275 m], 23 May 2003, *W. H. Lewis & M. Elvin-Lewis 15842* (MO).

ROSA CAROLINA × R. VIRGINIANA

Rosa virginiana Miller, Gard. Dict., ed. 8, no. 10. 1768, nom. cons. prop. TYPE: United Kingdom. England: cultivated, "*Rosa virginiana* Miller Dict., no. 10," probably in Solander's writing (BM, typ. cons. prop.).

Rosa virginiana is primarily a coastal species occurring from Newfoundland to New Jersey, and infrequently in Maryland, District of Columbia, and northeastern Virginia where *R. carolina* predominates. Within this range, *R. virginiana* also occurs inland for short distances or rarely farther as in New York, Onondaga Co., Green Lakes State Park, 2 July 1954, *W. H. Lewis 2180* (MO [2], US). Putative hybrids and their introgressants have been identified occasionally from Massachusetts to New Jersey where both species occur with some frequency and, rarely, farther south to the District of Columbia and surrounding areas. Thus, this hybridity and introgression is best established as the nothospecies *R. ×novae-angliae*.

3. Rosa ×novae-angliae W. H. Lewis, nothosp. nov. [*Rosa carolina* L. × *R. virginiana* Miller, nom. cons. prop.]. TYPE: U.S.A. Massachusetts: Berkshire Co., Lanesboro, sterile knoll, 16 July 1917, *J. R. Churchill s.n.* (holotype, MO 900712).

Frutex 0.6–1 m altus, infirmus, pendulus vel validus rectus varians, aculeis binatis infrastipularibus angustis vel crassis, foliolis in pagina adaxiali aliquanto nitidis, stipulis 3–6 mm latis, fructibus per florem vulgo 1 ad 4.

The most important characters useful for identifying *Rosa ×novae-angliae* (common name, New England rose) include: shrub height often intermediate, 0.6–1 m (*R. carolina* 0.3–1[–1.3] m tall; *R. virginiana* 0.5–2[–3] m tall); variable shrub habit (*R. carolina* stems thin and weak, pendent; *R. virginiana* stems thicker and stronger, upright); infrastipular prickles of fertile branches and stems straight and small-based and/or stout and broad-based (*R. carolina* thin, straight or occasionally declining, small-based; *R. virginiana* long, stout, straight or occasionally curved, broad-

based); leaflet upper (adaxial) surface somewhat glossy (*R. carolina* dull or slightly glossy; *R. virginiana* glossy); stipule width typically 3–6 mm broad (*R. carolina* narrow, 2–4 mm; *R. virginiana* broad, 4–9 mm); flower/fruit (hip) number per inflorescence commonly one to four (*R. carolina* one to three [to six], infrequently current-year shoots/turions with few-flowered corymbs; *R. virginiana* one to six [to 15], many-flowered corymbs more common on current-year shoots/turions); sepal length (*R. carolina* often shorter, from 12 mm; *R. virginiana* longer, from 20 mm). When using these characters, an equal or near equal representation of each species and/or intermediate state would strongly suggest hybridity. Distributional data obtained in a region where both parental species occur would add further evidence to that of morphology in identifying putative hybrids and their introgressants.

Paratypes. U.S.A. **District of Columbia**: Terra Cotta, 30 June 1911, *T. Holm s.n.* (MO); D.C. & vicinity, dry hills, 1 June & 10 June 1896, *E. S. Steele s.n.* (MO). **Massachusetts**: Middlesex Co., 2 mi. E of Dunstable, 224 ft. [68 m], 27 June 1954, *W. H. Lewis 2160* (MO); Norfolk Co., Framingham, 25 June 1897, *E. C. Smith s.n.* (MO). **New Jersey**: Cape May Co., N of Cape May City, 40 ft. [12 m], 19 May 2005, *W. H. Lewis & M. Elvin-Lewis 15974* (MO). **Pennsylvania**: Chester Co., 3 mi. S of Oxford, Nottingham barrens, serpentine, 10 June 1966, *C. F. Reed 78339* (MO). **Virginia**: Fairfax Co., Potomac River opposite Washington, D.C., 30 May 1889, *J. R. Churchill s.n.* (MO).

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Sinopora, A New Genus of Lauraceae from South China

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Abstract. The new genus *Sinopora* J. Li, N. H. Xia & H. W. Li is reported for the Lauraceae from Hong Kong in South China and is based on *Syndiclis hongkongensis* N. H. Xia, Y. F. Deng & K. L. Yip. The new genus is distinguished from *Syndiclis* Hooker f. by its trimerous flowers. The new genus is similar to *Hexapora* Hooker f., but its anthers are originally introrse and tubular, with two anther cells near each other and apically opening by minute pores, the staminodes as large as the stamens, but not produced above the stamens.

Key words: China, IUCN Red List, Lauraceae, *Sinopora*.

The species *Syndiclis hongkongensis* N. H. Xia, Y. F. Deng & K. L. Yip, collected from Tai Mo Shan, Hong Kong, China, was recently described for the Lauraceae (Xia et al., 2006) and greatly attracted our attention. After carefully checking the type specimens, the description, and the figure of the new species (Hu, 2003; Xia et al., 2006), we confirmed that it did not belong to the genus *Syndiclis* Hooker f. because of its trimerous flowers. This species has small, bisexual flowers in a slender axillary panicle of nine to 12 flowers. Its flower has six ovate tepals; the exserted stamens are six in two whorls, subsessile and eglandular; the tubular anther is 2-celled, these cells apically open by minute pores, the joint between the cell and the flap is on the abaxial side, the anthers are originally introrse; the staminodes of the third and fourth whorls are six, opposite to and as large as the stamens but not produced above them; the ellipsoid, sessile ovary is sparsely tomentose.

Vegetatively, the material looks quite like *Hexapora* Hooker f. species with slender branchlets and alternate, penninerved, conspicuously reticulate leaves. The axillary few-flowered paniculate inflorescence conforms to the basic configuration in *Hexapora*. The flower appears quite *Hexapora*-like with a short perianth, six exserted stamens, a 2-celled anther, its cells opening by minute pores, and six staminodes. However, we considered that the species is different from the monotypic genus *Hexapora* (Hooker, 1886, 1890; Kostermans, 1957; Kochummen, 1989; Rohwer, 1993; van der Werff, 2001). *Hexapora curtisii* Hooker f. has orbicular tepals and subquadrate anthers; the two anther cells are rounded, extrorse, and distant from each other; and the staminodes of the third and fourth whorls are produced above the stamens.

Syndiclis hongkongensis is also similar to species with six stamens in the genus *Beilschmiedia* Nees (Li et al., 1984; Hyland, 1989; Nishida, 1999). However, stamens in the latter genus have slit-like openings that open inward, with anther cells oriented sideways. We consider that this taxon from Hong Kong in South China does not fit a known genus within the Lauraceae and certainly represents a new genus, which we describe here.

Sinopora J. Li, N. H. Xia & H. W. Li, gen. nov. TYPE: *Sinopora hongkongensis* (N. H. Xia, Y. F. Deng & K. L. Yip) J. Li, N. H. Xia & H. W. Li.

Haec genus affinis *Hexaporae* Hooker f., sed staminibus 6, antheris tubularibus, 2-loculatis, loculis approximatis rotun-

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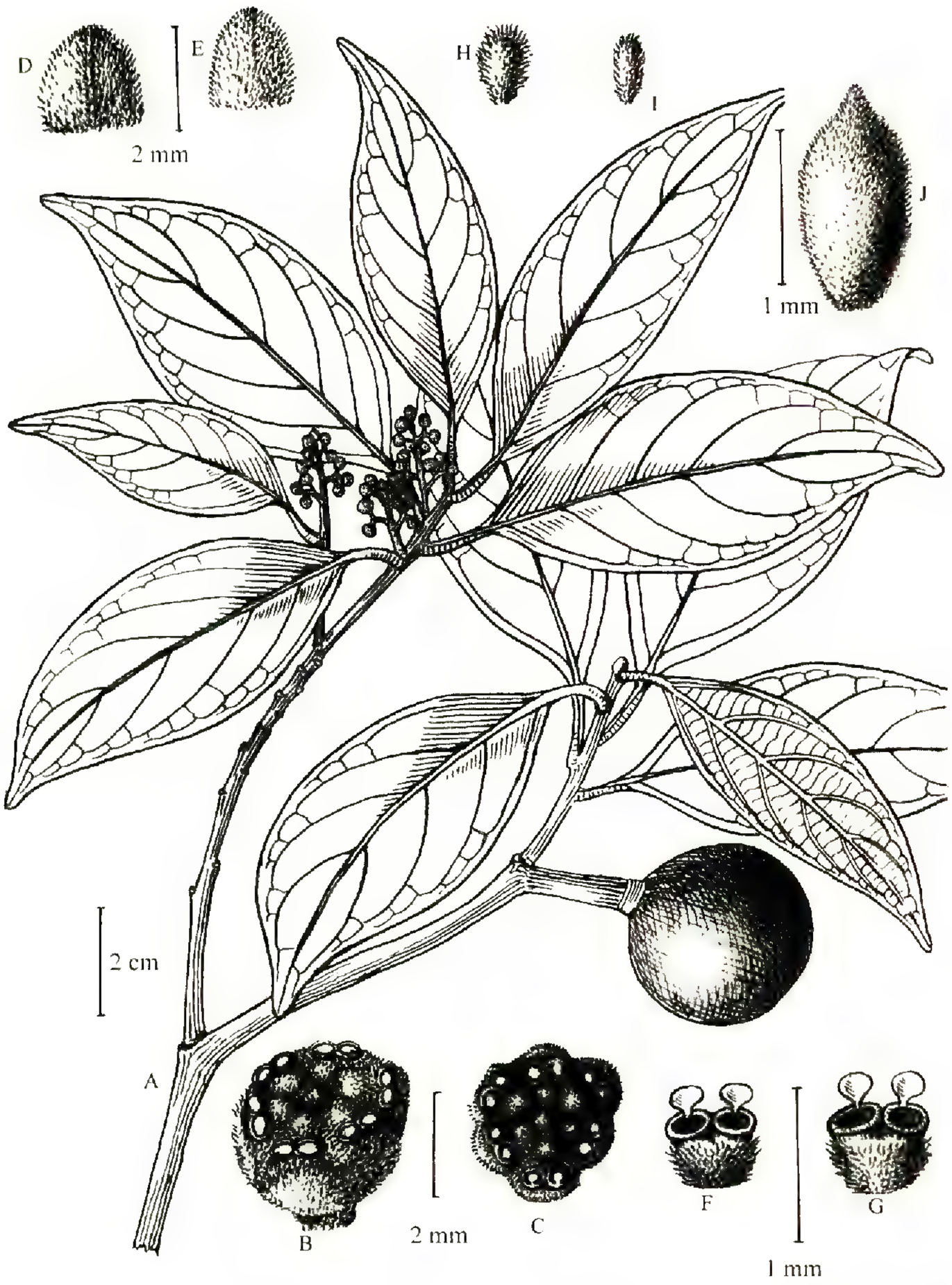

Figure 1. *Sinopora hongkongensis* (N. H. Xia, Y. F. Deng & K. L. Yip) J. Li, N. H. Xia & H. W. Li. —A. Flowering and fruiting branch. —B. Flower (lateral view). —C. Flower (apical view). —D, E. Tepals. —F, G. Stamens of the first and second whorls. —H, I. Stamens of the third and fourth whorls. —J. Ovary. Drawn by H. P. Yu from the type *N. H. Xia, Y. W. Lam & K. Y. Tam s.n.* (IBSC).

datis, per poros minutos apicales dehiscentibus; staminodiis antheras nec excedentibus differt.

Medium-sized tree; bark reddish brown, peeling off in small pieces; branchlets slender, lenticellate, at apex somewhat angular, glabrescent; terminal buds not perulate. Leaves alternate. Inflorescence axillary, paniculate, 9- to 12-flowered. Flowers small, bisexual and trimerous; perianth tube very short, tepals 6, equal, erect at anthesis, shorter than the stamens; stamens 6, eglandular, anthers tubular, 2-celled, cells small, adjacent to each other, rounded, opening by minute apical pores; staminodes 6, within the third and fourth whorls and opposite to stamens, villose, as large as stamens and not produced above them; ovary ellipsoid, sparsely tomentose, narrowed into a very short style; stigma minute. Fruit globose, rough, glabrescent; pedicel cylindrical.

Distribution and habitat. The genus is known from one species in Hong Kong, China, found in tropical or subtropical broad-leaved forests, at elevations below 450 m.

Etymology. The genus name is derived from "Sino" (China) and "pora" (referring to the minute pores of the anther cells).

Sinopora hongkongensis (N. H. Xia, Y. F. Deng & K. L. Yip) J. Li, N. H. Xia & H. W. Li, comb. nov. Basionym: *Syndiclis hongkongensis* N. H. Xia, Y. F. Deng & K. L. Yip, J. Trop. Subtrop. Bot. 14: 75–77, fig. 1. 2006. TYPE: China. Hong Kong: Tai Mo Shan, SE slope, 22°23′N, 114°08′E, 443 m, 20 Oct. 2005, *N. H. Xia, Y. W. Lam & K. Y. Tam s.n.* (holotype, IBSC; isotype, HK). Figure 1.

Tree to 16 m, ca. 90 cm diam. at base; branchlets reddish brown. Leaf buds ca. 3 mm, minutely puberulent; leaf blade leathery, elliptic, 6–10 ×

2.5–4 cm, base cuneate and asymmetrical, apex acuminate, with sharp tip, margin entire, glabrescent, adaxially dark green, abaxially pale green and glaucous, midrib and lateral nerves brownish, flat adaxially, prominent abaxially, pinninerved, lateral nerves in 4 to 5 pairs, veins densely reticulate; petiole slender, 1–2 cm, flat above. Inflorescences 2–3.5 cm, slender to 1 cm wide, tomentose, shortly pedunculate; peduncles to 0.5 cm, tomentose; bracteoles linear to triangular, rusty tomentose, ca. 3 × 1 mm. Flowers globose in bud, to 1.5 mm, greenish yellow; pedicels 2–4 mm; tepals 6, densely tomentose; stamens 6 in 2 whorls, slightly exserted, subsessile, tomentose; staminodes 6, ca. 0.5 mm; ovary with style tomentose at base. Fruit yellowish brown, to 4 cm diam., with persistent accrescent tepals at the base when young (fide N. H. Xia); fruiting pedicel ca. 2 cm, thickened under the fruit; pericarp woody, ca. 2 mm thick.

Distribution and habitat. The genus is very rare, with one mature tree and one young tree found in Tai Mo Shan, Hong Kong, China, at an elevation of 443 m.

IUCN Red List category. Following IUCN Red List criteria (IUCN, 2001), the conservation status of this species is Critically Endangered (CR B2ab[v]). Because the species occurs in the Country Park of Hong Kong under statutory protection, ex situ conservation measures are suitable.

Phenology. Observed in flower and fruit in October.

Discussion. The plant of so-called *Syndiclis furfuracea* H. W. Li was included in *Rare and Precious Plants of Hong Kong* (Hu, 2003) and also recorded in *Checklist of Hong Kong Plants* (Wu, 2002). However, this actually corresponds to *Sinopora hongkongensis* because its collection is from the same type tree in Tai Mo Shan, Hong Kong, South China. *Sinopora hongkongensis* clearly differs from *Syndiclis chinensis* C. K. Allen in its trimerous versus dimerous flowers as noted by Xia et al. (2006).

Up to now, there were no *Syndiclis* species known in Hong Kong but rather two *Beilschmiedia* species (*B. fordii* Dunn and *B. glandulosa* N. H. Xia, F. N. Wei & Y. F. Deng) occurring in that area. It is necessary to distinguish the new genus from *Beilschmiedia* as follows:

1a. Tepals longer than stamens; stamens exserted in flower; anther cell opening sideways, introrse or extrorse, slit-like . . . . . *Beilschmiedia*
1b. Tepals shorter than stamens; stamens included in flower; anther cell apically opening (originally introrse), rounded . . . . . *Sinopora*

Paratypes. CHINA. **Hong Kong**: Tai Mo Shan, SE slope, s.d., *L. T. Lo 737* (HK), *Y. W. Lam 1276* (HK).

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Nomenclatural Novelties and One New Species in *Orthosia* (Apocynaceae, Asclepiadoideae)

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ABSTRACT. Anticipating the full revision of the New World genus *Orthosia* Decaisne (Asclepiadeae, Orthosiinae), the following new combinations for 14 taxa formerly placed in *Amphistelma* Grisebach, *Cynanchum* L., *Metastelma* R. Brown, *Tassadia* Decaisne, and *Vincetoxicum* Wolf are provided: *Orthosia bonplandiana* (Roemer & Schultes) Liede & Meve, *O. calycina* (Schlechter) Liede & Meve, *O. cardozoi* (Morillo) Liede & Meve, *O. cassythoides* (Suessenguth) Liede & Meve, *O. ellemannii* (Morillo) Liede & Meve, *O. guilleminiana* (Decaisne) Liede & Meve, *O. henriqueana* (Silveira) Liede & Meve, *O. meridensis* (Morillo) Liede & Meve, *O. parviflora* (E. Fournier) Liede & Meve, *O. pearcei* (Rusby) Liede & Meve, *O. pubescens* (Greenman) Liede & Meve, *O. scoparia* (Nuttall) Liede & Meve, *O. selloana* (E. Fournier) Liede & Meve, and *O. stannardii* (Morillo) Liede & Meve. Full and comprehensive synonymies for *O. scoparia* and *O. guilleminiana* are given to preclude the confusing use of many different names for these widely distributed species. Lectotypification for 14 taxa is presented: *Amphistelma ephedroides* Grisebach, *A. filiforme* Grisebach, *A. riedelii* E. Fournier, *A. selloanum* E. Fournier, *Astephanus pubescens* Greenman, *Cynanchum bonplandianum* Roemer & Schultes, *C. trilobulatum* Lillo, *Metastelma angustifolium* Turczaninow, *M. atrorubens* Schlechter, *M. calycinum* Schlechter, *M. fawcettii* Schlechter, *M. peruvianum* Schlechter, *M. rariflorum* Schlechter, and *M. retinaculatum* Schlechter. *Orthosia woodii* Meve & Liede, a new endemic species from Bolivia, is described and illustrated.

Key words: Apocynaceae, Asclepiadoideae, Asclepiadeae, Bolivia, Central America, IUCN Red List, *Orthosia*, Orthosiinae, South America.

Orthosia Decaisne (Apocynaceae, Asclepiadoideae, Asclepiadeae, Orthosiinae) is a New World genus of ca. 40 species distributed from Florida to Argentina, with a center of distribution in Brazil. A generic revision of *Orthosia* is ongoing by the authors. However, as the completion of the work has taken more time than expected, compilers of South American floras such as the *Flora of Bolivia* have asked to have our new combinations validly published. The aim of this paper is to provide the needed nomenclatural information. The number of synonymous names under the accepted species names, as given here, is large; however, since the revisional work for the *Flora de Cuba* or *Flora of Ecuador* is not yet finished, the authors are hesitant to include their still incomplete compilation. This contribution is not a conspectus. Nevertheless, full synonymies are given for the most widely distributed species, *O. scoparia* (Nuttall) Liede & Meve and *O. guilleminiana* (Decaisne) Liede & Meve, to preclude their often confusing naming in flora treatments like the recently published regional ones from Brazil (Rapini, 2001; Fontella Pereira, 2005) and Mexico (Juárez-Jaimes & Lozada, 2003).

Since its description, *Orthosia* has suffered from the unclear circumscription of genera thought to belong to the *Cynanchum*-group in the New World, comprising *Cynanchum* L., *Metastelma* R. Brown, *Tassadia* Decaisne, or *Vincetoxicum* Wolf, as well as *Amphistelma* Grisebach and *Cyathostelma* E. Fournier. Consequently, Woodson (1941) subsumed *Orthosia* with all the other above-mentioned genera (except for *Cyathostelma*) under a very wide *Cynanchum*. It was up to Liede (1997) to show that a combination of characters such as green stems, short shoots, deciduous leaves (to which epithets such as "*aphyllum*" or "*ephedroides*" refer), often two inflorescences per node appearing preferentially at the defoliated stems, and paired mericarps distinguish *Orthosia* from the other three genera with similar tiny and twining habit and small "cynanchoid" flowers (refer to the highly representative plates depicting *O. scoparia* in Meyer, 1944: pl. 63 and 64). Liede-Schumann et al. (2005) added further evidence for the necessary separation of the American cynanchoid taxa from *Cynanchum* based on DNA sequence analysis. They demonstrated that *Orthosia* is not part of the Metastelmatinae and Cynanchinae clades and thus is neither related to *Cynanchum* s. str. nor to *Vincetoxicum*, *Tassadia*, or *Metastelma*. Instead, it forms a separate subclade (= Orthosiinae Liede & Rapini) together with the closely related *Jobinia* E. Fournier and some former *Cynanchum* species.

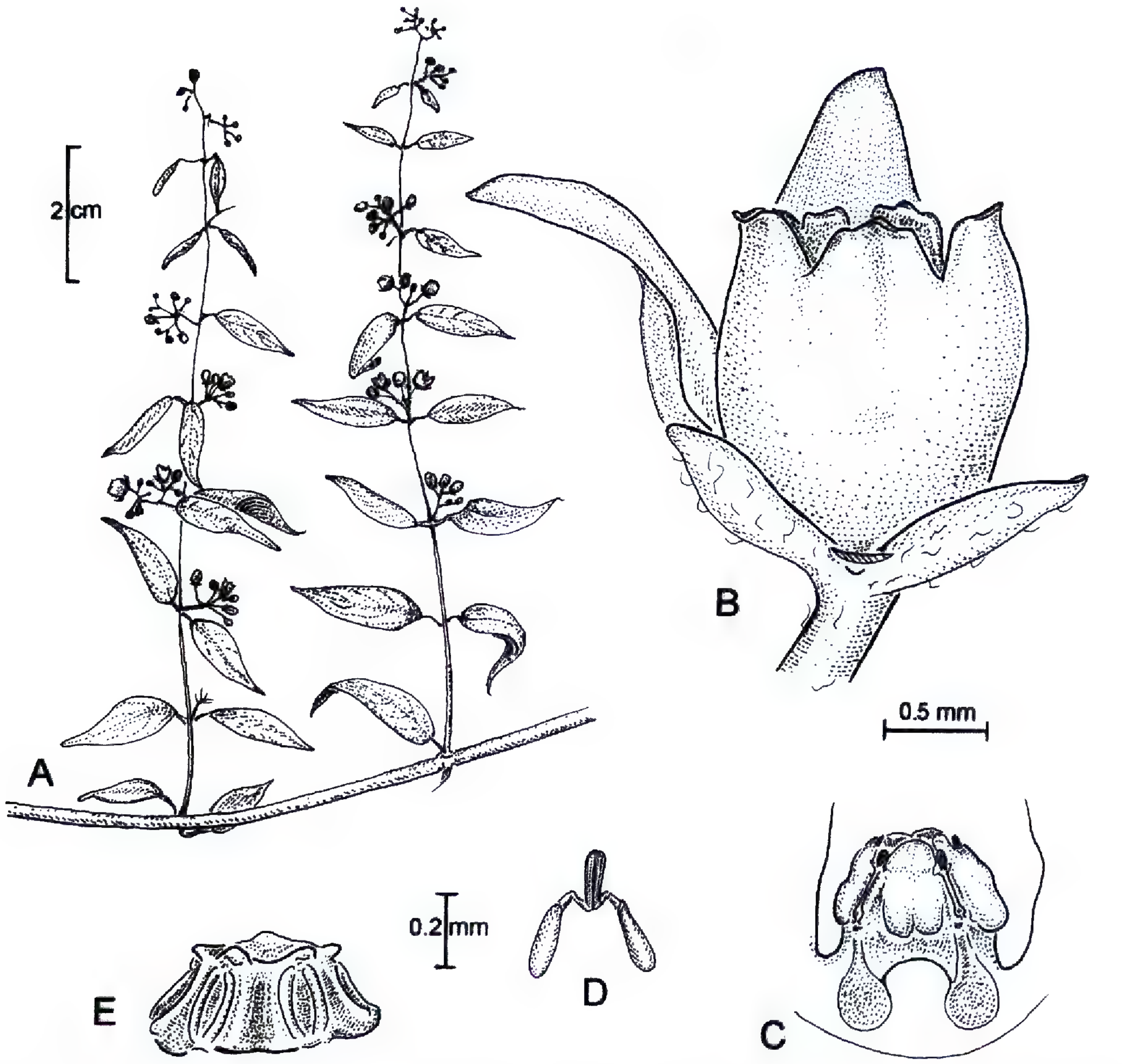

Figure 1. *Orthosia woodii* Meve & Liede. —A. Branch with flowering short shoots. —B. Flower (corolla partly removed). —C. Gynostegium in the laterally opened corona, with two nectaries indented into coronal tissue. —D. Pollinarium. —E. Style head in lateral view. Drawn by U. Meve from the isotype *Wood 10369* (UBT).

Species-level taxonomy for *Orthosia* is even more difficult than the generic delimitation of the group, because even for Asclepiadoideae, reliable qualitative characters are rare and the use of quantitative characters is difficult because they show a vast variability within one species and even within one population depending on the age of the specimen and the spot of growth. In addition, flowers are among the smallest in the family, down to 1.2 mm in diam. as in *O. meridensis* (Morillo) Liede & Meve.

A New Species in Bolivia

Orthosia woodii Meve & Liede, sp. nov. TYPE: Bolivia. Chuquisaca: Boeto, S pass above Nuevo Mundo on rd. to Villa Serrano, 19°00′S, 64°19′W, 2300 m, 3 Jan. 1996, *J. R. I. Wood 10369* (holotype, K; isotype, UBT). Figure 1.

Orthosiae selloanae (E. Fournier) Liede & Meve similis corona late connata, sed differt foliis multo latioribus, lobiis coronae indistincte trifidis et marginibus antherarum fertilium brevibus.

Plants twining vines to 3 m tall, numerously and dichasially branched, with distinct long and short herbaceous to semi-succulent shoots; internodes sparsely pilose along a single line with recurved trichomes of 150–200 µm; internodes of long shoots 70–110 × ca. 1 mm, those of short shoots 15–25 × 0.2–0.5 mm. *Leaves* with petioles 1–2 mm, with 2 colleters at the adaxial base; blades discolorous, 15–20 × 5–7 mm, ovate-lanceolate, basally rounded, apically acute, adaxially and abaxially sparsely pilose along midvein and margins with appressed trichomes 100–120 µm. *Inflorescences* extra-axillary, always one per node, sciadioidal, 7- to 11-flowered, 2 to 7 flowers open synchronously, these subsessile to pedunculate; peduncles to 5 mm, sparsely pilose along a single line

with erect or recurved trichomes, 150–200 μm; floral bracts 0.6–1 × 0.4–0.6 mm, ovate, distinctly acute, glabrous; pedicels 2.5–4 mm, sparsely puberulous with flexuous trichomes, 250–300 μm. *Floral buds* 1.8–2 × 1–1.2 mm diam., conical; *calyx* basally fused, rotate to campanulate, abaxially glabrous; lobes 0.8–1.2 × 0.4–0.6 mm, ovate, apically acute; *corolla* 1.8–2 mm; lobes fused for ca. 1/4 of total corolla length, 0.8–1 mm wide, patent to horizontal, ovate, acute, cream, glabrous; *gynostegial corona* of almost completely fused staminal lobes, cream, 1.5–1.7 mm, at least twice as long as the gynostegium; lobes ovate; apically trifid with side lobes smaller than central lobe, erect to inflexed; *gynostegium* ca. 0.5 × 0.7 mm, broader than long, atop a short stipe of 100–200 μm, broadly conical; anthers ca. 350 μm, broader than long, trapezoidal, abaxially gibbose, anther wings ca. 250 μm, at ca. 30° angles, anther wings of adjacent anthers parallel to each other, in the same plane as the anther, basally widened, forming a distinct mouth; connective appendages ca. 150 × 250 μm, broadly ovate, strongly inflexed; *pollinarium* with a corpusculum ca. 180 × 60 μm, oblanceolate; caudicles ca. 90 μm, cylindrical, geniculate; pollinia apically attached to the caudicles, vertical to slightly spreading (70°–90°), ca. 220 × 80 μm, ovate in cross section, oblong; style head ca. 360 × 900 μm, upper part ca. 80 μm tall, much shorter than the lower part, umbonate. *Fruits*, *seeds*, and *chromosome number* unknown.

Distribution and habitat. South America. Bolivia, Chuquisaca Department, in dense moist Tacaman forest that covers steep hillsides.

IUCN Red List category. *Orthosia woodii* is most likely not restricted to the type collection and the single population known. However, it is apparently rare and of narrow distribution and is therefore to be categorized as Endangered (EN) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Collected with flowers in January.

Etymology. *Orthosia woodii* is named after John R. I. Wood, Honorary Research Associate of Kew Herbarium and recognized expert of Bolivian plant life. He has collected around 20,000 specimens, many of them representing new species.

Relationships. The flower of *Orthosia woodii* resembles *O. selloana*, especially with regard to the highly fused corona, a character that is otherwise absent in the entire genus. However, with its broadly lanceolate leaves, *O. woodii* differs in habit from *O. selloana*, which bears much longer and smaller lanceolate leaves of 25–50 × 4–10 mm. Comparing the flowers, differences are found in details of the corona, which is urceolate with vaguely trifid lobes in *O. woodii*, but cyathiform and emarginate to even fringed in *O. selloana*. The structure of the gynostegia is most significant in distinguishing the new species. The guide rails are not protruding and shorter than the fertile parts of the anthers in *O. woodii* (Fig. 1C). In contrast, the guide rails are protruding and nearly twice as long as the fertile parts of the anthers in *O. selloana*. Finally, the nectaries are deeply indented into the base of the corona in *O. woodii*, and this is highly conspicuous and otherwise unseen in the genus.

Nomenclatural Novelties in *Orthosia*

Fourteen new combinations with *Orthosia* are proposed in the following pages. Geographically, the whole distribution area of the genus, ranging from Florida, the Caribbean, and Mexico in the north to Argentina in the south, is concerned.

1. **Orthosia bonplandiana** (Roemer & Schultes) Liede & Meve, comb. nov. Basionym: *Cynanchum bonplandianum* Roemer & Schultes, Syst. Veg. 6: 98. 1820, replacement name for *Cynanchum lanceolatum* Kunth, Nov. Gen. Sp. (quarto ed.) 6: 203. 1818, nom illeg., *Vincetoxicum lanceolatum* (Kunth) Kuntze, Revis. Gen. Pl. 2: 424. 1891, nom. illeg., non *Cynanchum lanceolatum* Poiret, Encycl., Suppl. 2: 430. 1812. TYPE: Mexico. s. loc., s.d., *K. Kunth* (lectotype, designated here, M [259]; isotype, P).

Metastelma bonplandianum (Roemer & Schultes) Schlechter (in Urban, Symb. Antill. 1(2): 259. 1899) was based on *Cynanchum bonplandianum* Roemer & Schultes; however, the specimen cited there, *Wright 2963*, is the type of *Amphistelma graminifolium* Grisebach, now a synonym of *Orthosia scoparia* (see below). The type specimen in M bears the annotation that Munich received it from the Berlin herbarium, where the holotype is lost. This fact, together with the quality of the specimen, which possesses more branches than the one in P, is a good reason to select it as lectotype.

2. **Orthosia calycina** (Schlechter) Liede & Meve, comb. nov. Basionym: *Metastelma calycinum* Schlechter, Bot. Jahrb. Syst. 54 (Beibl. 119): 1. 1916. *Cynanchum calycinum* (Schlechter) Morillo, Ernstia 2(3–4): 68. 1992. TYPE: Peru. Cajamarca: Jaen, bei der Mündung des Chinchipe den Marañon, ca. 400–500 m, May 1912, *A. Weberbauer 6227* (lectotype, designated here, US; isotype, GH).

For a long time, this species was only known from the type collection. Recently, however, it has been re-collected in Cajamarca (*M. Weigend et al. 7530*, B). Morphological characters (habit and size of plants and flowers, smooth corolla surface, basally fused corona, pollinaria shape) and molecular data (Liede-Schumann & Meve, unpublished data) clearly place it in *Orthosia*. Its large sepals, more or less as long as the corolla lobes, make this species easy to identify. The type specimen in US shows well-preserved and richly flowering material, which was used for our detailed investigation. Therefore, we chose it as lectotype, replacing the destroyed holotype in B.

3. Orthosia cardozoi (Morillo) Liede & Meve, comb. nov. Basionym: *Cynanchum cardozoi* Morillo, Ernstia 3(2): 62. 1993. TYPE: Venezuela. Aragua: Parque Nac. H. Pittier, Pico Guacamaya, 19 Jan. 1991, *A. Cardozo 1685* (holotype, MY not seen; isotype, VEN).

True *Cynanchum* in the New World is restricted to a handful of species belonging to subgenus *Mellichampia* (A. Gray) Woodson, all characterized by the possession of 'pseudostipules' (Liede & Täuber, 2002). This character is missing in *C. cardozoi*, which suggests a different genus affiliation. Indeed, in its character combination this species can be recognized as *Orthosia* immediately, considering the tiny spreading growth, small lanceolate leaves, and the small size of flowers. Florally, the smooth corolla surfaces and the fused corona also refer to *Orthosia*.

4. Orthosia cassythoides (Suessenguth) Liede & Meve, comb. nov. Basionym: *Cynanchum cassythoides* Suessenguth, Mitt. Bot. Staatssamml. München 1: 8. 1950. TYPE: Venezuela. Tovar, 1934, *C. Vogl 1391* (holotype, M).

As is the species above, *Cynanchum cassythoides* is misplaced in *Cynanchum* (sensu Liede & Täuber, 2002; Liede-Schumann et al., 2005). The richly branched, green stems that are leafless in the dry period, small lanceolate leaves, tiny flowers, and fused corona demonstrate without doubt that this species belongs to *Orthosia*.

5. Orthosia ellemannii (Morillo) Liede & Meve, comb. nov. Basionym: *Cynanchum ellemannii* Morillo, Nord. J. Bot. 14: 283. 1994. TYPE: Ecuador. Loja: Loma-Zamora, 12 km from Loja, on finca of Dr. David Espinosa, 79°09′W, 03°55′S, 2400 m, 30 Sep. 1988, *L. Ellemann 66527* (holotype, AAU; isotypes, QCA, VEN).

This species is misplaced in *Cynanchum* (cf. Liede & Täuber, 2002; Liede-Schumann et al., 2005). It also shows the character combination so typical for *Orthosia*, such as many-branched, green stems that are leafless in the dry period, lanceolate leaves, tiny flowers, fused corona, and paired and narrow mericarps. In addition, its generic affiliation has been proven by DNA sequence analysis (Liede-Schumann et al., 2005).

6. Orthosia guilleminiana (Decaisne) Liede & Meve, comb. nov. Basionym: *Vincetoxicum guilleminianum* Decaisne, Prodr. (DC.) 8: 526. 1844. *Metastelma guilleminianum* (Decaisne) Malme, Ark. Bot. 21A: 11. 1927. TYPE: Brazil. São Paulo: s. loc., Feb. 1839, *M. Guillemin s.n.* (holotype, P; isotype, P).

Amphistelma pallidum Silveira, Fl. Serr. Min. 16. 1908. Syn. nov. TYPE: Brazil. Minas Gerais: entre Ubá e Serraria, Serra do Treituba, Aug. 1895, *H. Magalhães 288* (holotype, R).

Amphistelma riedelii E. Fournier, Fl. Bras. (Martius) 6(4): 225. 1885. Syn. nov. *Vincetoxicum riedelii* (E. Fournier) Kuntze, Revis. Gen. Pl. 2: 425. 1891. TYPE: Brazil. s. loc., s.d., *L. Riedel 311* (lectotype, designated here, P; isotypes, GH, K).

Cynanchum miserum L. O. Williams, Fieldiana, Bot. 32: 38. 1968. Syn. nov. *Metastelma miserum* (L. O. Williams) W. D. Stevens, Phytologia 64: 335. 1988. *Orthosia misera* (L. O. Williams) W. D. Stevens, Novon 15: 636. 2005. TYPE: Guatemala. Alta Verapaz: Pansamalá, *H. v. Türckheim 1290* (holotype, US; isotypes, F, GH).

Cynanchum rubens L. O. Williams, Fieldiana, Bot. 32: 39. 1968. Syn. nov. *Metastelma rubens* (L. O. Williams) W. D. Stevens, Phytologia 64: 335. 1988. *Orthosia rubens* (L. O. Williams) W. D. Stevens, Novon 15: 637. 2005. TYPE: Guatemala. Chimaltenango: Santa Elena, 27 July 1933, *A. F. Skutch 503* (holotype, US; isotype, NY).

Cynanchum trilobulatum Lillo, Physis 4: 424. 1919. Syn. nov. TYPE: Argentina. Tucumán: Famailla. Quebrada de Lules, 15 May 1929, *S. Venturi 9067* (lectotype, designated here, NY; isotype, LIL not seen).

Metastelma angustifolium Turczaninow, Bull. Soc. Imp. Naturalistes Moscou 25: 315. 1852. Syn. nov. TYPE: Mexico. Veracruz: Mirador, 1000 m, Oct. 1838, *J. Linden 1353* (lectotype, designated here, P).

Metastelma glaberrimum Woodson, Ann. Missouri Bot. Gard. 24: 200. 1937. Syn. nov. *Cynanchum glaberrimum* (Woodson) L. O. Williams, Fieldiana, Bot. 32: 36. 1968. *Orthosia glaberrima* (Woodson) W. D. Stevens, Novon 15: 635. 2005. TYPE: Panama. Chiriquí: Valley of the upper Río Chiriquí Viejo, near Monte Lirio, 11 July 1935, *R. J. Seibert 300* (holotype, MO).

Metastelma pallidum Rusby, Descr. S. Amer. Pl. 96. 1920. Syn. nov. TYPE: Colombia. Magdalena: Cacagualita, cordillera de Santa Martha, 10 Jan. 1899, *H. Smith 1900* (holotype, NY; isotypes, DAO, GH [2], L, MA, MICH, MO, P, S, US).

Metastelma retinaculatum Schlechter, Bot. Jahrb. Syst. 37: 610. 1906. Syn. nov. TYPE: Bolivia. Tarija: San Diego

near San Luis, E Tarija, 10 Apr. 1904, *K. Fiebrig 2761* (lectotype, designated here, K).

Comparable to the situation in *Orthosia scoparia* as described below, *O. guilleminiana* represents a widespread, even more variable species complex distributed from Mexico to Argentina. It includes various regional or local variants that do not differ much vegetatively except for the size of leaves (6–20 mm long), and more substantially in the size of flowers, color of corolla (mostly greenish to yellowish, rarely whitish or purplish), and the shape and size of the staminal corona lobes (rectangular, ovate to deltoid, with emarginate, acuminate, trifid or dentate apices, ascending and flattened or spreading and recurved). As a result of these eye-catching differences, many different taxa have been described covering the different regional variants. However, we regard these as superficial differences, and the characters of flower size and color, as well as corona morphology, as unreliable specific markers. Instead, we propose to recognize this species on the basis of the following characters and character states: (mostly) with long and short shoots; short shoots with shorter internodes and smaller leaves than long shoots and usually bearing the majority of flowers; corona cyathiform; gynostegium conical with anther wings (guide rails) centrifugal over the whole length at an angle of 55°–65°, and twice as long as the sterile part of the anther; and caudicles convexly recurved. The plate of the synonymous *Cynanchum trilobulatum* in Meyer (1944: pl. 66) gives a relatively good illustration of this species; however, the gynostegium depicted as almost longer than broad, is broader than long in all specimens, even those from Argentina.

Of the two syntypes of *Amphistelma riedelii* cited by the author (Fournier, 1885) and still available at P, the specimen *Glaziou 11203* has many more leaves but lacks fully developed flowers. The *Riedel 311* collection, on the other hand, shows some intact flowers and is therefore selected here as the lectotype.

Of the two syntypes (*Venturi 9067*, *Lillo 4933*) given in Lillo's (1919) protologue of *Cynanchum trilobulatum*, only the *Venturi 9067* specimens seem still existent. The specimen in NY, which has many flowers and is in perfect condition, is selected here as lectotype.

In the absence of holotype material, the only available specimen of the type, *J. Linden 1353*, found at P is designated as lectotype of *Metastelma angustifolium* (Turczaninow, 1852).

The specimen of *Fiebrig 2761* in K represents the only available type material of *Metastelma retinaculatum* (Schlechter, 1906) and thus has to serve as lectotype.

7. Orthosia henriqueana (Silveira) Liede & Meve, comb. nov. Basionym: *Amphistelma henriqueanum* Silveira, Fl. Serr. Min. 16. 1908. TYPE: Brazil. Minas Gerais: Serra de Mantiqueira, May 1896, *H. Magelhães 287* (holotype, R).

As late as Malme (1900: 28), who differentiated between *Amphistelma* and *Orthosia* only on the basis of details of the pollinaria, the retention of *Amphistelma* against *Orthosia* in taxonomic use broke down successively, with the last descriptions in *Amphistelma* being *A. pearcei* Rusby in 1907, *A. henriqueanum* and *A. chloranthum* Silveira in 1908, *A. leptocarpa* Rusby in 1920, and the combination *A. scoparium* (Nuttall) Small made in 1913. Since then, most *Amphistelma* taxa have been transferred to *Orthosia* (or *Metastelma* or *Cynanchum*, depending on taxonomic preference), but *A. henriqueanum* has been overlooked so far. Nevertheless, it also shows the character combination of green stems with lanceolate leaves, tiny flowers with a smooth corolla, and a basally fused corona as typical *Orthosia* prerequisites. At species level, it is characterized by its very small flowers ca. 1.5 mm in diameter and very small triangular corona lobes, but with long and acute connective appendages.

8. Orthosia meridensis (Morillo) Liede & Meve, comb. nov. Basionym: *Cynanchum meridense* Morillo, Ernstia 2(1–2): 8. 1992. TYPE: Venezuela. Mérida: Dpto. Rivas Dávila, a 15 km en la carr. Tovar–Guaraque, 9 Aug. 1976, *C. Benitez de Rojas 2067* (holotype, MY not seen; isotypes, MO, VEN).

Orthosia meridensis is another of those species originally described in *Cynanchum*, but clearly belonging to *Orthosia* because of a spreading habit, green stems with lanceolate, deciduous leaves, and tiny flowers with a smooth corolla and a basally fused corona. This placement is also supported by molecular data (Liede-Schuman & Meve, unpublished data). At species level, it is characterized by extremely small flowers ca. 1.2 mm diam., suberect corolla lobes, and a cyathiform corona with blunt, broadly ovate to subrotundate corona lobes.

9. Orthosia parviflora (E. Fournier) Liede & Meve, comb. nov. Basionym: *Amphistelma parviflorum* E. Fournier, Fl. Bras. (Martius) 6(4): 224. 1885. *Vincetoxicum fournieri* Kuntze, Revis. Gen. Pl. 2: 424. 1891, replacement name for *Vincetoxicum parviflorum* Decaisne, Prodr. (DC.) 8: 525. 1844. *Metastelma brasiliense* K. Schumann in

Engler & Prantl, Nat. Pflanzenfam. 4(2): 241. 1895, replacement name for *Metastelma parviflorum* (Swartz) R. Brown ex Schultes, Syst. Veg. 6: 120. 1820. TYPE: Brazil. Rio de Janeiro: Chemin des Crannin au Alto da Boa Vista de N Friburgo, 22 Jan. 1874, *A. Glaziou 6904* (holotype, P [3]; isotypes, K, P, R).

This species is indeed difficult to place, since it deviates from the typical habit known for *Orthosia* as stressed above with its oval and pubescent leaves. Unfortunately, no material recent enough for DNA sequencing was available. However, the flowers are very small (ca. 3 mm diam.), the corolla lobes are smooth and deltoid, and the corona is basally fused. These features, again, constitute a typical character combination for *Orthosia*, which is never found in *Metastelma*.

10. Orthosia pearcei (Rusby) Liede & Meve, comb. nov. Basionym: *Amphistelma pearcei* Rusby, Bull. New York Bot. Gard. 4: 411. 1907. TYPE: Bolivia. Yungas: Coripata, 15 Mar. 1894, *M. Bang 2089* (holotype, NY; isotypes, GH, M, MO).

This is a less typical *Orthosia* species because of its dense pubescence, broadly ovate leaves, and long hairs on the outer corolla surface. Its tiny flowers with glabrous inner corolla surface, the fused cyathiform corona with deltoid and slightly cucullate lobes, and the paired mericarps, however, clearly force its placement in *Orthosia*. Erroneously, Meyer (1944: 153, fig. 72; 1977: 177, fig. 15.1) described and depicted this species as *Cynanchum bonariense* (Decaisne) Meyer based on *Ditassa bonariensis* Decaisne.

11. Orthosia pubescens (Greenman) Liede & Meve, comb. nov. Basionym: *Astephanus pubescens* Greenman, Proc. Amer. Acad. Arts 32: 299. 1897. *Metastelma pubescens* (Greenman) W. D. Stevens, Phytologia 53: 405. 1983. TYPE: Mexico. Morelos: wet barranca above Cuernavaca, 2000 m, 21 Sep. 1896, *C. G. Pringle 6507* (lectotype, designated here, GH; isotypes, MO, NY, P).

Of the two syntypes indicated in the protologue, *Pringle 6507* and *Pringle 7203*, both collected near Cuernavaca on 21 Sep. 1986 and 3 Aug. 1896, respectively, *Pringle 6507* is the more complete and widely distributed collection. The GH specimen is particularly rich in flowers, and therefore chosen as lectotype.

12. Orthosia scoparia (Nuttall) Liede & Meve, comb. nov. Basionym: *Cynanchum scoparium* Nuttall, Amer. J. Sci. 5: 291. 1822. *Cynoctonum scoparium* (Nuttall) Chapman, Fl. South U.S.: 367. 1860. *Vincetoxicum scoparium* (Nuttall) Alph. Wood, Amer. Bot. Fl.: 274. 1870, non *Vincetoxicum scoparium* (Nuttall) A. Gray, Syn. Fl. N. Amer. 2(1): 102. 1878, nom. illeg. *Metastelma scoparium* (Nuttall) Vail, Fl. S.E. U. S.: 950. 1903. *Amphistelma scoparium* (Nuttall) Small, Fl. Miami: 149. 1913. TYPE: U.S.A. Florida: Oct.–Nov. 1821, *A. Ware s.n.* (holotype, PH).

Amphistelma angulatum E. Fournier, Fl. Bras. (Martius) 6(4): 226. 1885. TYPE: Brazil. Rio de Janeiro: Canta Galo, *T. Peckolt s.n.* (lectotype, designated by Fontella Pereira, 1990: 26, BR).

Amphistelma chloranthum Silveira, Fl. Serr. Min. 17. 1908. Syn. nov. TYPE: Brazil. Minas Gerais: João Ayres, June 1898, *A. Silveira 289* (holotype, R).

Amphistelma ephedroides Grisebach, Cat. Pl. Cub. 174. 1866. Syn. nov. *Cynanchum ephedroides* (Grisebach) Alain, Mem. Soc. Cub. Hist. Nat. "Felipe Poey" 22: 120. 1955. *Metastelma ephedroides* (Grisebach) Schlechter in Urban, Symb. Antill. 1(2): 262. 1899. TYPE: Cuba. Monte Verde, 1860, *C. Wright 2962* (lectotype, designated here, GOET; isotypes, GH, MO, P).

Amphistelma filiforme Grisebach, Fl. Brit. W. I. 418. 1864. Syn. nov. *Metastelma filiforme* (Grisebach) C. Wright apud Sauvalle, Anales Acad. Ci. Méd. Habana 7: 106. 1870, non *Metastelma filiforme* (Grisebach) K. Schumann in Engler, Prantl, Nat. Pflanzenfam. 4(2): 241. 1895, nom. illeg. *Cynanchum sauvallei* Alain, Mem. Soc. Cub. Hist. Nat. "Felipe Poey" 22: 120. 1955, replacement name for *Amphistelma filiforme* Grisebach, non *Cynanchum filiforme* Jacquin, Select. Stirp. Amer. Hist. 86. 1763. TYPE: Jamaica. St. Mary, Oct. 1839, *McNab s.n.* (lectotype, designated here, P).

Amphistelma graminifolium Grisebach, Cat. Pl. Cub. 174. 1866. Syn. nov. *Cynanchum graminifolium* (Grisebach) Alain, Mem. Soc. Cub. Hist. Nat. "Felipe Poey" 22: 119. 1955. TYPE: Cuba. s. loc., 1860, *C. Wright 2963* (holotype, GOET [numbered as 593 by *Grisebach*, cf. Howard, 1988]; isotypes, GH, MA, MO, NY [3], P, S [2]).

Amphistelma tomentosum E. Fournier, Fl. Bras. (Martius) 6(4): 226. 1885. *Vincetoxicum tomentosum* (E. Fournier) Kuntze, Revis. Gen. Pl. 2: 425. 1891. *Orthosia tomentosa* (E. Fournier) Malme, Ark. Bot. 16(15): 17. 1920. *Tassadia subulata* (Vellozo) Fontella & E. A. Schwarz var. *tomentosa* (E. Fournier) Fontella, Eugeniana 17: 26. 1990. TYPE: Brazil. Rio de Janeiro: Campos de Bocaina, 8 Sep. 1908, *M. Glaziou 11602* (lectotype, designated by Fontella Pereira, 1990: 27, K).

Cynanchum floridum Vellozo, Fl. Flumin. 3: 123. 1829. *Tassadia subulata* (Vellozo) Fontella & E. A. Schwarz var. *florida* (Vellozo) Fontella & E. A. Schwarz, Bol. Mus. Bot. Mun. (Curitiba) 57: 4. 1982. TYPE: Tab. 86 in Vellozo, 1831, Fl. Flumin. Vol. 3 (lectotype, designated by Fontella Pereira & Schwarz, 1982: 4).

Cynanchum subulatum Vellozo, Fl. Flumin. 3: 121. 1829. *Tassadia subulata* (Vellozo) Fontella & E. A. Schwarz,

Bol. Mus. Bot. Mun. (Curitiba) 57: 1. 1982. TYPE: Tab. 85 in Vellozo, 1831, Fl. Flumin. Vol. 3 (lectotype, designated by Fontella Pereira & Schwarz, 1982: 1).

Metastelma atrorubens Schlechter in Urban, Symb. Antill. 1(2): 263. 1899. Syn. nov. *Cynanchum atrorubens* (Schlechter) Alain, Mem. Soc. Cub. Hist. Nat. "Felipe Poey" 22: 120. 1955. TYPE: Jamaica. Westphalia Rd., ca. 1000 m, Dec. 1897, *W. Harris 6921* (lectotype, designated here, P).

Metastelma fawcettii Schlechter in Urban, Symb. Antill. 1(2): 260. 1899. Syn. nov. *Cynanchum fawcettii* (Schlechter) Stearn, Phytologia 21: 138. 1971. TYPE: Jamaica. Tweedside (St. Andrew septentrionalis), ca. 830 m, Sep. 1898, *W. Harris 7404* (lectotype, designated here, GOET; isotypes, S [2]).

Metastelma peruvianum Schlechter, Bot. Jahrb. Syst. 37: 609. 1906. Syn. nov. *Cynanchum peruvianum* (Schlechter) Morillo, Ernstia 2(3–4): 69. 1992. TYPE: Peru. Dept. Junín, Prov. Tarma: entre Palca y Huacapistana, ca. 2000–2100 m, 8 Jan. 1903, *A. Weberbauer 2041* (lectotype, designated here, G; isotypes, MOL not seen, USM).

Metastelma rariflorum Schlechter, Bot. Jahrb. Syst. 37: 610. 1906. Syn. nov. TYPE: Peru. Dept. Puno: inter Sandia et Cuyocuyo, 2100–2200 m, 27 Apr. 1902, *A. Weberbauer 845* (lectotype, designated here, MOL not seen, photo, NY).

Vincetoxicum leptocladum Decaisne, Prodr. (DC.) 8: 526. 1844. Syn. nov. *Amphistelma leptocladon* (Decaisne) Grisebach, Fl. Brit. W. I. (Grisebach): 418. 1864. *Metastelma leptocladon* (Decaisne) Schlechter in Urban, Symb. Antill. (Urban) 1(2): 261. 1899. *Cynanchum leptocladum* (Decaisne) J. Jiménez Almonte, Rhodora 62: 238. 1960. TYPE: Dominican Republic. St. Domingo, s.d., *H. Nectoux s.n.* (holotype, P).

Vincetoxicum melanthum Decaisne, Prodr. (DC.) 8: 526. 1844. *Amphistelma melanthum* (Decaisne) E. Fournier, Fl. Bras. (Martius) 6(4): 226, tab. 61. 1885. *Metastelma melanthum* (Decaisne) K. Schumann in Engler & Prantl, Nat. Pflanzenfam. 4(2): 241. 1895. *Orthosia melantha* (Decaisne) Malme, Ark. Bot. 16(15): 17. 1920. *Cynanchum melanthum* (Decaisne) T. Meyer in Descole, Gen. Sp. Pl. Arg. 2: 141, tab. 63. 1944. TYPE: Brazil. Rio Grande, 1833, *C. Gaudichaud 719* (holotype, P).

Another, illegitimate name also refers to this taxon:

Cynanchum aphyllum Vellozo, Fl. Flumin. 3: 122. 1829, nom. illeg., non *Cynanchum aphyllum* L., Syst. Nat. 12: 235. 1768. *Amphistelma aphyllum* (Vellozo) E. Fournier, Fl. Bras. (Martius) 6(4): 226. 1885. *Vincetoxicum aphyllum* (Vellozo) Kuntze, Revis. Gen. Pl. 2: 424, 1891. *Orthosia aphylla* (Vellozo) Malme, Ark. Bot. 16(15): 16. 1920. TYPE: Tab. 83, Vellozo, 1831, Fl. Flumin. Vol. 3 (lectotype, designated by Fontella Pereira & Schwarz, 1982: 2).

Orthosia scoparia is the most widespread *Orthosia* species, since it is not only restricted to Central and South America as is the other widespread species *O. guilleminiana*, but is also a frequent element of the floras of Florida and the Caribbean, in particular Cuba. Nevertheless, it shows a high constancy regarding key characters such as the small lanceolate, deciduous leaves, a gynostegium broader than high with semi-orbicular to broadly ovate corona lobes not exceeding the gynostegium, and a pollinarium with exceptionally long and thin caudicels (cf. Meyer, 1944: pl. 64, fig. f).

All taxa synonymized in the following fit well under this description with only slight variations in the size of internodes, leaves, flowers, and corona lobes. The occasional occurrence of flowers with a dark red-colored corolla, initially described as *Vincetoxicum melanthum*, has caused some confusion. However, yellow- and red-colored variants within a single species, sometimes within the same population, and without any other morphological deviation are not rare and are without taxonomic relevance in Asclepiadoideae (also in *Orthosia guilleminiana* with the synonymous *O. rubens*, in *Matelea nigra* (Decaisne) Morillo & Fontella, or in the stapeliads of the Old World tribe Ceropegieae [Meve, unpublished data]). Despite its characteristic appearance (see above), *O. scoparia* has been shuffled around taxonomically. In Brazil it is still mostly treated as *Tassadia subulata* (Fontella Pereira, 2005), in the U.S.A. as *Cynanchum scoparium* (e.g., Wunderlin, 1982), and in Cuba as *C. ephedroides* (e.g., León & Alain, 1974), just to name the most widely used combinations.

We herein follow Howard (1988: appendix 1, 159) in selecting the specimen of *Wright 2962* at GOET, certainly seen by Grisebach, as lectotype of *Amphistelma ephedroides*. The previous lectotypification of Howard (1988) appeared only on microfiche but not in print, so it cannot be accepted as effectively published (cf. Rankin Rodríguez & Greuter, 2000; Krings & Fantz, 2006).

Wright (1870), when combining *Amphistelma filiforme* with *Metastelma*, referred to the specimen *Wright 405*, so that later authors, e.g., Schlechter (1899: 262), were obviously committed to the idea that *Wright 405* must represent the type of this taxon. Nowadays, many such so-called isotypes of *A. filiforme*, based on *Wright 405*, are distributed in different herbaria (GH, NY, P, S). However, Grisebach (1864) in the original protologue of the basionym *A. filiforme* named four syntypes, but none of them is *Wright 405*. Of these four syntypes, only *McNab s.n.* could be traced, and it is here selected to serve as lectotype. *Cynanchum sauvallei* Alain replaced the name *A. filiforme* Grisebach, because the combination *C. filiforme* was blocked by the earlier and heterotypic *C. filiforme* Jacquin, which, in fact, is a synonym of *Funastrum clausum* (Jacquin) Schlechter. As a classificatory action often disregarded later, *A. ephedroides* and *A. graminifolium* Grisebach have been treated as synonyms under *Metastelma filiforme* (Grisebach) C. Wright by Wright (1870: 106).

Metastelma atrorubens (Schlechter, 1899) represents just another red-flowered variant of the *Orthosia scoparia* complex. The explicit search for holotypes by W. Harris of *M. atrorubens* and *M. fawcettii* was unsuccessful. Neither species is extant in the holdings of A or GH, and our query to UCWI remained without response. In the absence of any trusted holotype, we select the isotype of P as lectotype for *M. atrorubens*.

The selected lectotype material of *Metastelma fawcettii*, *Harris 7404*, shows stronger stems and larger leaves than usual in *Orthosia scoparia*; however, the flowers do not differ from typical *O. scoparia*, and *M. fawcettii* is therefore regarded as a further synonym. No original material could be located. The two duplicate specimens in S are poor in leaves and flowers, whereas the specimen in GOET is much better equipped, and it is therefore selected to serve as lectotype.

The holotype of *Metastelma peruvianum* (Schlechter, 1906) was destroyed in Berlin in 1943. The duplicate specimen at G is selected as lectotype, because it is in good condition and is more accessible for the scientific community than the isotypes at MOL or USM.

Léon (2006) explicitly states the existence of a specimen of *Weberbauer 845* at MOL and correctly regards it as an isotype of *Metastelma rariflorum*. Because of the loss of the holotype in B, and in the absence of any other complete isotype, we herewith select this specimen as the lectotype.

13. Orthosia selloana (E. Fournier) Liede & Meve, comb. nov. Basionym: *Amphistelma selloanum* E. Fournier, Fl. Bras. (Martius) 6(4): 224. 1885. *Vincetoxicum selloanum* (E. Fournier) Kuntze, Revis. Gen. Pl. 2: 425. 1891. TYPE: Brazil. SE Brazil, s.d., *F. Sellow 226* (lectotype, designated here, US).

Amphistelma leptocarpa Rusby, Descr. S. Am. Pl. 98. 1920. Syn. nov. TYPE: Colombia. Magdalena: Cordillera Sierra Marta, Sierra del Libano, 1828 m, 23 Jan., *H. H. Smith 1679* (holotype, NY; isotypes, GH, MA, P, S).

Flowers of *Orthosia selloana* are characterized by the highly fused coronal cup, which is similar to that of *O. woodii* (Fig. 1B) and *O. urceolata* E. Fournier, although the corolla is more urceolate in the latter species. Short anthers and protruding guide rails twice as long as in the other two species, most comparable to those found in *O. kunthii* Decaisne, also distinguish *O. selloana*. Because no significant morphological differences between the types of *O. selloana* and *Amphistelma leptocarpa* could be found, except for a slightly more lobed and fringed coronal cup in *A. leptocarpa*, the latter taxon is here treated as a later synonym of *O. selloana*. The protologue (Fournier, 1885: 225) gives three numbers of *Sellow* (*226*, *303*, and *385*) as syntypes. Sellow's collections were usually deposited in B (Vegter, 1987), but none of these specimens are extant there. *Sellow 226* is duplicated at US, *Sellow 385* in NY, and *Sellow 305* could not be traced. As the US and NY specimens are very similar in quality, we selected the US specimen as lectotype, which corresponds to the one used for our morphological analysis.

14. Orthosia stannardii (Morillo) Liede & Meve, comb. nov. Basionym: *Cynanchum stannardii* Morillo, Ernstia 51: 6. 1989. TYPE: Venezuela. Amazonas: Dpto. Río Negro, Cerro de La Neblina, Camp V, valley N base of Pico Cardona, 21 Mar. 1984, *Liesner & Stannard 16890* (holotype, VEN; isotypes, K, MO).

Orthosia stannardii is only known from the type. Vegetatively, it is a typical *Orthosia* with its tiny green shoots and small lanceolate and deciduous leaves, with a strong resemblance to *O. ellemannii*. Florally, however, it is closest to *O. pearcei* with its minute flowers (ca. 1.5 mm diam.), somewhat cucullate corona lobes, and protruding, comparatively long guide rails.

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Bouvardia borhidiana (Rubiaceae, Cinchonoideae), una Nueva Especie de la Sierra Madre del Sur, México

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RESUMEN. *Bouvardia borhidiana* Lozada-Pérez se describe e ilustra de Guerrero, México. Esta nueva especie se caracteriza por sus ramas verdes y glabras, corola hipocraterimorfa y glabra por dentro y las ramas del estigma pubescentes. Se discute su relación con *B. laevis* M. Martens & Galeotti.

ABSTRACT. *Bouvardia borhidiana* Lozada-Pérez is described and illustrated from Guerrero, Mexico. This new species is distinguished by green and glabrous branches, hypocrateriform corolla with a glabrous internal side, and by the pubescent branches of its stigma. Its relation with *B. laevis* M. Martens & Galeotti is discussed.

Key words: *Bouvardia*, Cinchonoideae, Guerrero, IUCN Red List, Mexico, Rubiaceae.

En el curso de la preparación del tratamiento del género *Bouvardia* Salisbury para la flora del estado de Guerrero, México, se han estado revisando colectas recientes realizadas en el municipio de Malinaltepec, una región poco explorada. La región de estudio incluye la localidad tipo de *Edithea floribunda* Standley (Rubiaceae, Cinchonoideae) y cuyo hábitat es compartido con la siguiente novedad.

Bouvardia borhidiana Lozada-Pérez, sp. nov. TIPO: México. Guerrero: Mun. Malinaltepec: Tres Marías, 17°07′44.7″N, 98°41′34.2″W, 21 Nov. 2005, *L. Lozada-Pérez y R. de Santiago 2976* (holotipo, FCME; isotipos, MEXU, MO). Figura 1.

Bouvardiae laevi M. Martens & Galeotti affinis, sed caulibus juvenilibus viridibus et glabris, hypanthio atropurpureo, corolla hypocrateriformi intus glabra, stigmate ramis adaxialiter pubescentibus differt.

Plantas sufrútices, hasta 80 cm de alto; tallos glabros, ramas jóvenes de color verde y huecas cuando secas. Hojas opuestas, pecioladas; estípulas unidas en una vaina interpeciolar, blanco verdosas en fresco y café claras en seco, de 2.5–3 mm, glabras, el ápice con una seta central y 2 a 3 laterales, la central de 5.5–6.5 mm, las laterales de 2–3 mm, glabras y con ápice glandular, pecíolo de 1–2.5 cm, aplanado y con margen ligeramente alado, glabro; lámina de la hoja 6–14 × 2.5–4.5 cm, elíptica, estrechamente elíptica a estrechamente ovada, ápice agudo a acuminado, margen entero, ligeramente estrigoso, base decurrente, membranácea, glabra en ambas superficies, pinnado-nervadas, nervio medio deprimido por arriba y elevado por abajo, de 7 a 8 pares de venas secundarias. Inflorescencia terminal, 3 por rama, cimosa, 2 veces dividida, pedunculada, de 3.5–8 cm, brácteas foliáceas, de 1.5–3 × 0.7–1.5 cm, elípticas, glabras, pedúnculos de 1.5–5 cm, glabros, pedicelos de 1–2 mm, glabros. Flores heterostilas, tetrámeras, hipanto turbinado comprimido, de color púrpura oscuro, de 2–2.5 × 2.5–3 mm, copa del cáliz de 0.3–0.5 mm, lóbulos del cáliz iguales, externamente de color púrpura oscuro en la mitad inferior, verdes en el interior, erectos a divergentes cuando secos, de 4.5–10 × 0.8–1 mm, lanceolados a oblongos, glabros, con 2 a 3 glándulas en cada seno; corola de color magenta-rojizo, hipocrateriforma, prefloración valvada, de 2–2.5 cm, externa e internamente glabras, tubo de 1.7–2 cm y distalmente de 4–5 mm diám., lóbulos de 2.5–3 × 2.5–3 mm, muy ampliamente ovados, apiculados, glabros y papilosos en el ápice, divergentes 45°; flores corto-estiladas con los estambres incluidos, anteras dorsifijas, oblongo-elipsoides, de 3–3.5 × ca. 1.5 mm, anteras incluidas ca. 1 mm por abajo del ápice del tubo, filamentos de 0.5–0.7 mm; estilo de 8–8.5 mm, glabro, estigma bífido, de 2–2.3 mm, ramas adaxialmente pubescentes en toda su longitud; flores largo-estiladas con los estambres insertos, anteras incluidas ca. 3 mm por abajo del ápice del tubo; estilo 1.8–2 cm de largo, exerto, glabro, estigma de 1–1.4 mm de largo, ovario de 2 cavidades, placentas unidas a la mitad del septo. Cápsulas loculicidas, turbinado-comprimidas, de color púrpura pálido a gris, de 3.5–4 × 5–6 mm en su parte más amplia y 3 mm en la más estrecha, sépalos persistentes, acrescentes, hasta 1 cm, pedicelos de 6–10 mm y pedúnculos hasta 7 cm; semillas discoides, café oscuras o negras, de 1.5–2 mm diám., el margen alado, de ca. 0.2 mm, entero, superficie densamente areolada, las areolas isodiamétricas a poligonales.

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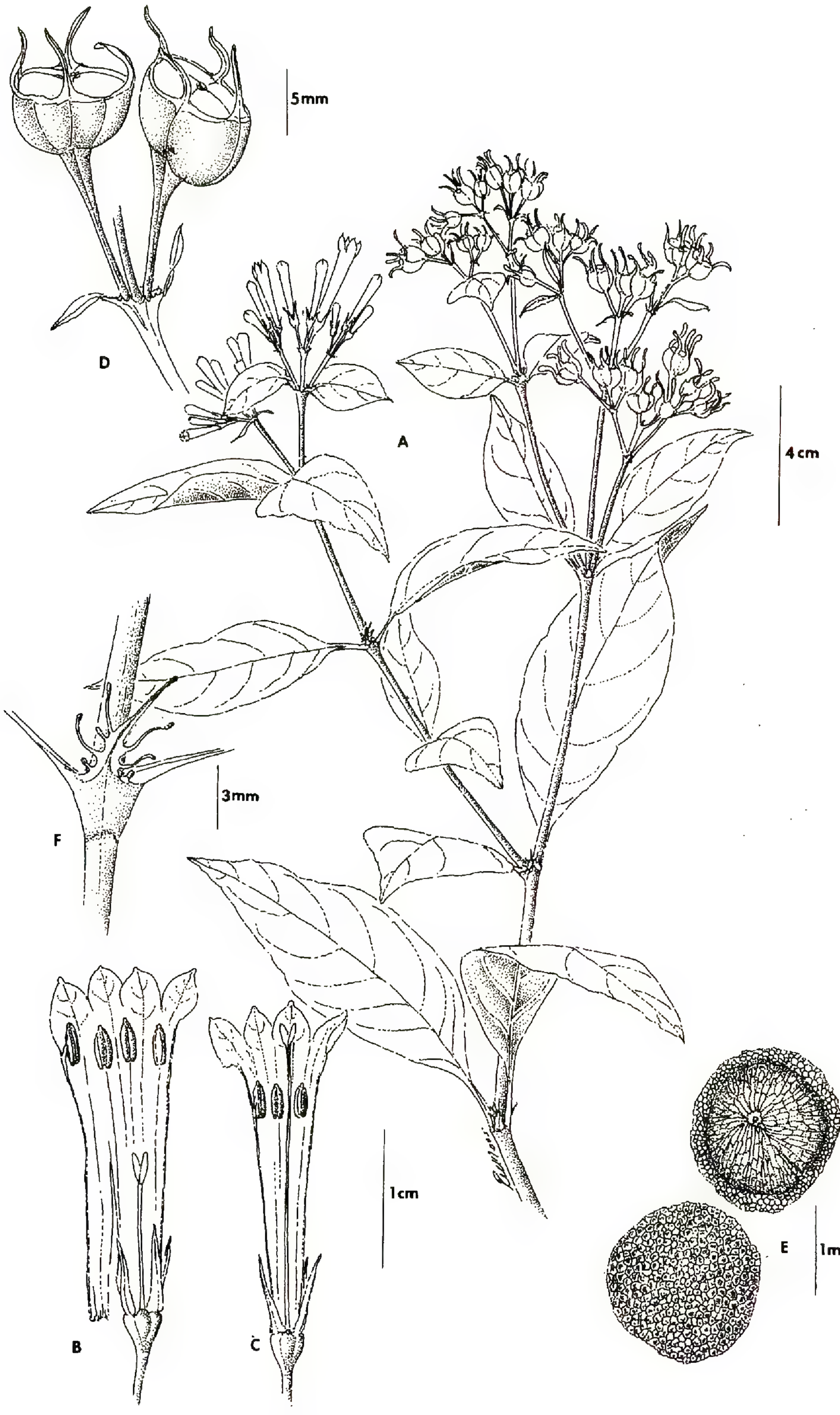

Figura 1. *Bouvardia borhidiana* Lozada-Pérez. —A. Rama con flores y frutos jóvenes. —B. Flor corto-estilada mostrando los estambres y el estilo. —C. Flor largo-estilada mostrando los estambres y el estilo. —D. Frutos. —E. Semilla. —F. Estípula. Dibujo basado en el holotipo *L. Lozada-Pérez y R. de Santiago 2976* (FCME).

Distribución y estado de conservación. Se conoce de tres localidades de la porción Oriental de la Sierra Madre del Sur; dos en el estado de Guerrero, en la región de la Montaña, cerca de los límites con el estado de Oaxaca, en los municipios de Alcozauca y Malinaltepec y otra en el estado de Oaxaca, en el distrito de Santiago Juxtlahuaca. Debido a su distribución restringida, *Bouvardia borhidiana* debe

considerarse en la categoría de especies en peligro de la lista roja de IUCN (IUCN, 2001), según los siguientes criterios: EN B1ab (i, ii, iii).

Hábitat. Bosque mesófilo de montaña, dominado por especies de los géneros *Magnolia* L., *Photinia* Lindley, *Dendropanax* Decaisne & Planchon, *Billia* Peyritsch y *Quercus* L., entre otros, y bosque de *Quercus–Pinus*, de 2200 a 2900 m de altitud. En Guerrero, en el municipio de Malinaltepec, el hábitat es compartido con *Edithea floribunda* (Rubiaceae, Cinchonoideae), especie de distribución restringida, conocida de dos localidades, una en Guerrero y otra en Oaxaca.

Fenología. Florece y fructifica posiblemente todo el año.

Etimología. Esta especie se nombra en honor del Dr. Attila Borhidi (1932–) por su contribución al conocimiento de las Rubiáceas Mesoamericanas.

Discusión. Bouvardia borhidiana (Rubiaceae, Cinchonoideae) se incluye en el subgénero *Bouvardiastrum* Schlechtendal (Blackwell, 1968) por tener hojas opuestas e inflorescencias cimosas. La combinación de caracteres como ramas jóvenes de color verde y huecas cuando secas, hipantio de color púrpura oscuro y glabro, corola hipocrateriforma y glabra por dentro no son compartidos por alguna especie conocida. *Bouvardia borhidiana* ha sido confundida con *B. laevis*, sin embargo los miembros de esta especie son arbustos altos de hasta 1.5 m, con el hipantio de color verde y pubescente, corola tubular, internamente pilosa en la mitad inferior y las ramas del estigma papilosas adaxialmente.

Paratipos. MÉXICO. **Guerrero**: Mun. Alcozauca, 3.1 km al SE de Zaragoza, cerca del Cerro Metlapil, *A. Santamaría 40* (FCME); Mun. Malinaltepec, aprox. 1.1 km al SE de Tres Marías, *R. de Santiago y L. Lozada 1721* (FCME, MEXU, XAL); al E de Tres Marías, *L. Lozada y R. de Santiago 3000* (FCME, MEXU, XAL); a 1.5 km al E de Tres Marías, *L. Lozada, R. de Santiago y J. Rojas 3036* (FCME); Tres Marías, *L. Lozada, R. de Santiago y J. Rojas 3048* (ENCB, FCME, MEXU). **Oaxaca**: Distr. Santiago Juxtlahuaca, Mun. Martín Peras, a 1 km de la desviación al poblado de Escopeta, carr. Coicoyan de las Flores Santiago Juxtlahuaca, *J. I. Calzada 20132* (MEXU).

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A New Species of *Parodia* (Cactaceae, Notocacteae) from Rio Grande do Sul, Brazil

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Abstract. A new species, *Parodia gaucha* M. Machado & Larocca (Cactaceae, Notocacteae), from Encruzilhada do Sul, Rio Grande do Sul, Brazil, is described and illustrated. The new species is morphologically very similar to *P. muricata* (Otto ex Pfeiffer) Hofacker but can be distinguished from the latter by the presence of a conical projection below each areole, the higher number of shallower and narrower ribs, more closely spaced areoles, higher number of spines, different color of the spines, and seeds with minutely striate testa-cell surfaces.

Resumo. Descreve-se e ilustra-se uma nova espécie, *Parodia gaucha* M. Machado & Larocca (Cactaceae, Notocacteae), proveniente de Encruzilhada do Sul, Rio Grande do Sul, Brasil. A nova espécie é morfologicamente muito similar a *P. muricata* (Otto ex Pfeiffer) Hofacker, mas pode ser distinguida desta última pela presença de uma projeção cônica abaixo de cada aréola, por apresentar um número mais elevado de costelas que são menos profundas e de menor largura, menor espaçamento entre aréolas, maior número de espinhos, por possuir espinhos de diferente coloração e sementes cujas células da testa possuem uma superfície finamente estriada.

Key words: Brazil, Cactaceae, campos, IUCN Red List, Notocacteae, pampas, *Parodia*, Rio Grande do Sul.

Parodia Spegazzini, as circumscribed by the Cactaceae Working Party of the International Organization for Succulent Plant Study (Hunt & Taylor, 1986, 1990), comprises about 60 to 70 species of mostly globular or occasionally subcolumnar cacti (Barthlott & Hunt, 1993; Hunt, 1999, 2006; Anderson, 2001) distributed through the eastern part of central South America. The species occur in two centers of diversity (Buxbaum, 1964, 1966–1967, 1967a, b, 1975; Endler & Buxbaum, 1974): (1) the lowland pampas regions of southern Brazil (particularly in the state of Rio Grande do Sul), Uruguay, eastern Paraguay, and northeastern Argentina; and (2) on the eastern slopes of the Andes in northwestern Argentina and eastern Bolivia. Many species have limited distribution ranges and are often threatened by grazing, agriculture, and habitat modification.

The stems of *Parodia* generally have tuberculate ribs, but a few taxa, e.g., *P. haselbergii* (Rümpler) F. H. Brandt and *P. microsperma* (F. A. C. Weber) Spegazzini, differ in having distinct tubercles arranged in helical lines. The flowers of most *Parodia* species are large and funnel- or occasionally bell-shaped, brightly colored, and pollinated by solitary bees (Schlindwein, 1995). The flowers arise near the stem apex, and the outside of the floral tube and the pericarpel is covered with bristles and hairs. The genus is characterized by having seeds with a straight or occasionally very slightly curved embryo and a large hilum-micropylar region (Barthlott & Voit, 1979; Barthlott & Hunt, 2000). Many of the seeds possess a prominent, either pad-, dome-, or balloon-shaped strophiole associated with the hilum-micropylar region.

A number of well-circumscribed subgroups can be recognized in *Parodia*, some of which were recognized as distinct genera in the past. One such subgroup is the group of species related to *P. ottonis* (Lehmann) N. P. Taylor. This group consists of species placed in the formerly separate genus *Notocactus* (K. Schumann) Frič (now subsumed under *Parodia*) and comprises

the species included in *Notocactus* ser. *Fricianae* Havlíček (nom. inval., ICBN Art. 36.1 [McNeill et al., 2006]) and *Notocactus* ser. *Paucispini* (Frič & Kreuzinger) Havlíček: *P. carambeiensis* (Buining & Brederoo) Hofacker, *P. linkii* (Lehmann) R. Kiesling, *P. muricata* (Otto ex Pfeiffer) Hofacker, *P. ottonis*, *P. oxycostata* (Buining & Brederoo) Hofacker, *P. stockingeri* (Prestlé) Hofacker & P. J. Braun, and *P. tenuicylindrica* (F. Ritter) D. R. Hunt. This group of species currently lacks a formal infraspecific taxon name under *Parodia*, and thus is referred here with the informal name *P. ottonis* group. Plants of the *P. ottonis* group share the morphological synapomorphy of producing offsets on short stolons, which often initially develop underground. Recent molecular systematic studies (Nyffeler, 1999; Machado et al., in prep.) have confirmed the monophyly of the *P. ottonis* group.

In 2005 and 2006 the first author traveled extensively in the state of Rio Grande do Sul, Brazil, sampling populations of the *Parodia ottonis* group in order to infer species limits in this group and investigate infra- and interspecific relationships by studying morphological and molecular variation patterns for species delimitation analyses. During the course of one of the field excursions, a population of a distinctive taxon belonging to the *P. ottonis* group was found that represents a morphologically distinct entity; it is described here as a new species.

Parodia gaucha M. Machado & Larocca, sp. nov. TYPE: Brazil. Rio Grande do Sul: Mun. Encruzilhada do Sul, 90 m, 27 Oct. 2006, *M. Machado 865* (holotype, ZSS; isotypes, HASU, HUEFS, MO). Figures 1, 2.

Haec species *Parodiae muricatae* (Otto ex Pfeiffer) Hofacker affinis, sed projecturis infra quamque areolam conicis, costis numerosioribus angustioribus minus profundis, areolis densius dispositis, spinis numerosioribus coloribus diversis, cellulis testae seminis tenuiter striatis differt.

Plant body clavate to short-cylindric, 9–12 × 5–8 cm, producing offsets from areoles located at the lower portion of the body; offsets first subterranean, produced on short stolons ca. 0.1 cm diam. and to 2 cm long; epidermis bright green; cortical tissues not mucilaginous, yellowish green in the upper portion of the body but becoming orange toward the base; ribs 18 to 22, straight, well-defined but slightly tuberculate, with shallow sinuses between successive tubercles, 0.2–0.4 cm tall × 0.6–1.0 cm thick, edges serrate due to a conical projection (triangular in lateral view) below each areole; areoles located at the sinuses between consecutive tubercles, rounded, 0.2–0.25 cm diam., densely set, 0.3–0.4 cm apart, with pale yellowish wool when young, later glabrescent; spines spreading, acicular, straight, almost bristly, 0.5–0.8 × 0.01–0.03 cm; central spines 6, golden yellow to reddish orange, hardly distinguished from the radials; radial spines 18 to 26, pale yellow; flowering areoles producing longer and curved spines to 1.5 cm. Flower buds with a dense cover of pale brownish hairs; flowers subapical, diurnal, opening for one to several days about 5 hours after sunrise and closing 4 hours later, shortly funnelform, to 4 × 5 cm; floral tube to ca. 1 cm, internal walls colored purplish red on the lower 1/3, yellow above; external walls yellowish green, with triangular bract scales subtending areoles that bear pale brownish to cream-yellow hairs and long yellowish bristles to 2 cm; perianth multiseriate, perianth segments pale yellow, lanceolate; stamens numerous (hundreds), spreading, arranged along the inner walls of the floral tube, sensitive and closing around the style when touched, lowermost stamens with filaments purplish red on the lower 1/3 to lower 1/2, yellow above; filaments to 0.7 cm; style yellow, ca. 1.6 × 0.2 cm; stigma lobes exserted, 10 to 12, dark red. Fruit 1.0–1.4 × 0.8–1.0 cm, greenish yellow, pericarpel with areoles bearing long yellowish brown hairs and a few curly bristles, dehiscing by one or more longitudinal slits, pulp white; dry perianth remnants either persistent on the fruit or falling off; seeds 1.0–1.2 × 0.8–0.9 mm, helmet-shaped, dark reddish brown to black, shiny; hilum-micropylar region 0.8–0.9 mm, pear-shaped, lateral to the seed axis, rim of hilum-micropylar region sharply edged against the testa, without bulging; testa cells convex, mostly pentagonal or hexagonal, ca. 50–100 × 30–80 µm, elongated along the seed axis; cell boundaries straight, sunken; cell surface with a minutely striate cuticular folding pattern.

Distribution and habitat. *Parodia gaucha* is at present known solely from its type locality in the municipality of Encruzilhada do Sul, Brazil, where it grows among rock outcrops in open grassland areas on hillsides and hilltops. The area consists of more or less rounded hills rising to ca. 300 m in altitude. The vegetation in the region is a composite of shrubby savanna-like vegetation on the lower parts of the hills, gallery forests in the valleys, and the grassland vegetation known as campos or pampas on the upper parts of the hills. In habitat *P. gaucha* grows in sympatry with other species of Cactaceae: *P. ottonis*, *Frailea pygmaea* (Spegazzini) Britton & Rose, *Cereus hildmannianus* K. Schumann, *Opuntia* Miller sp., *Rhipsalis* Gartner spp., and *Lepismium* Pfeiffer spp.

IUCN Red List category. The population of *Parodia gaucha* is small, consisting of a few dozen individuals, the majority of which were located on a

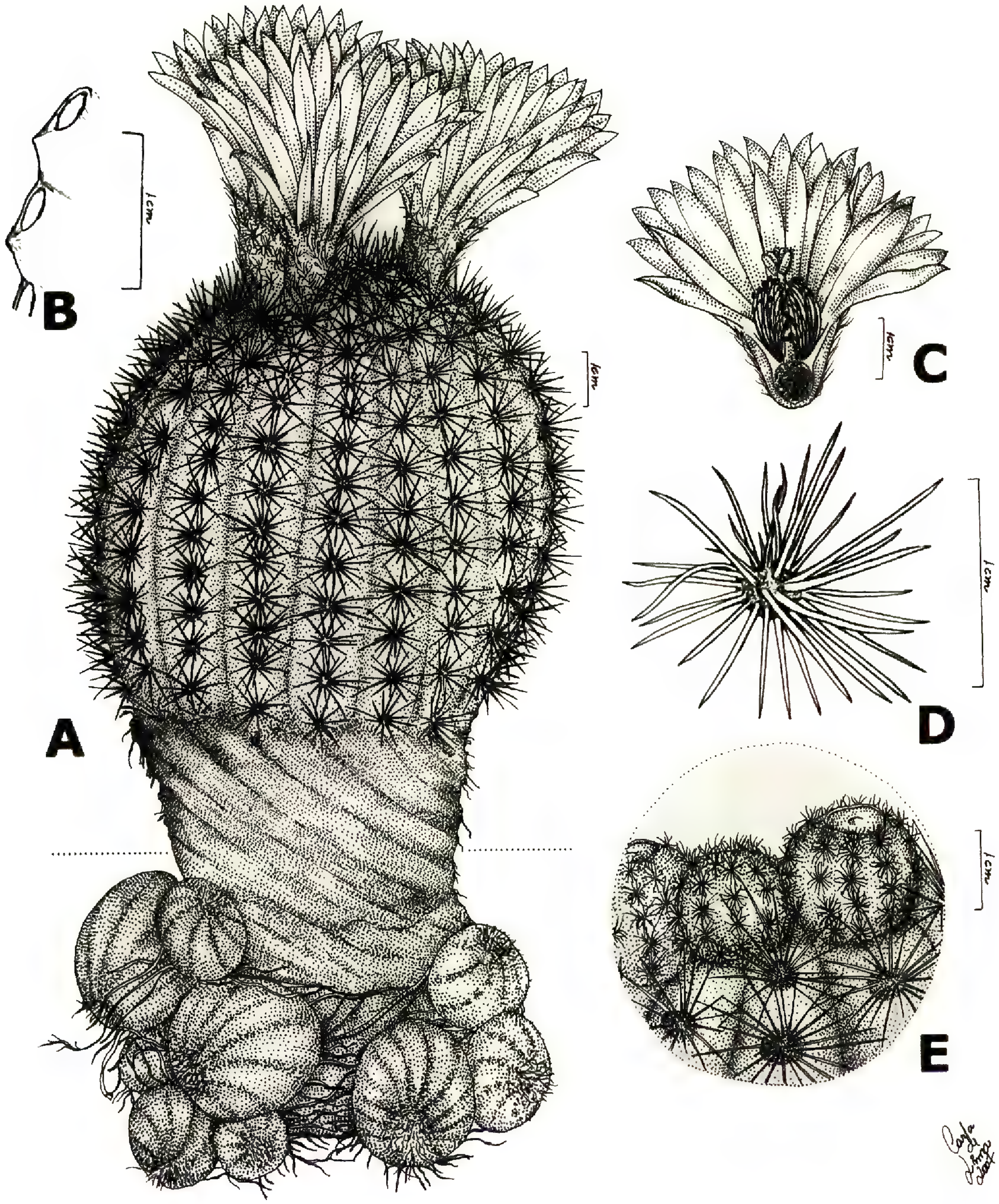

Figure 1. *Parodia gaucha* M. Machado & Larocca. —A. Habit; notice the underground offsets produced on short stolons (the dotted line indicates the soil line). —B. View of a rib with spines removed from the areoles, showing the conical projection below each areole. —C. Longitudinal section of a flower. —D. Typical areole with six central spines and 26 radial spines; the central spines hardly differentiable from the radials. —E. Detail of the fruits. Drawn from the holotype *M. Machado 865* (ZSS).

single rocky wall at the margin of a country road. An extensive search of the surrounding area revealed that suitable rock outcrops among the grassland held very few plants, the majority of which displayed signs of being trampled and grazed by cattle and sheep. Due to the apparent rarity, restricted distribution, and observed threats, it seems prudent to include *P. gaucha* in the Critically Endangered category of the IUCN Red List of endangered plant species according to the following criteria (IUCN, 2001): CR A2a B1ab(iii,v) C2a(ii) D.

Due to the rarity of *Parodia gaucha* at its single known locality, no paratypes have been collected.

Etymology. The specific epithet is derived from the vernacular term "gaúcho" (feminine form: "gaúcha"), which in Brazil designates the natives from the

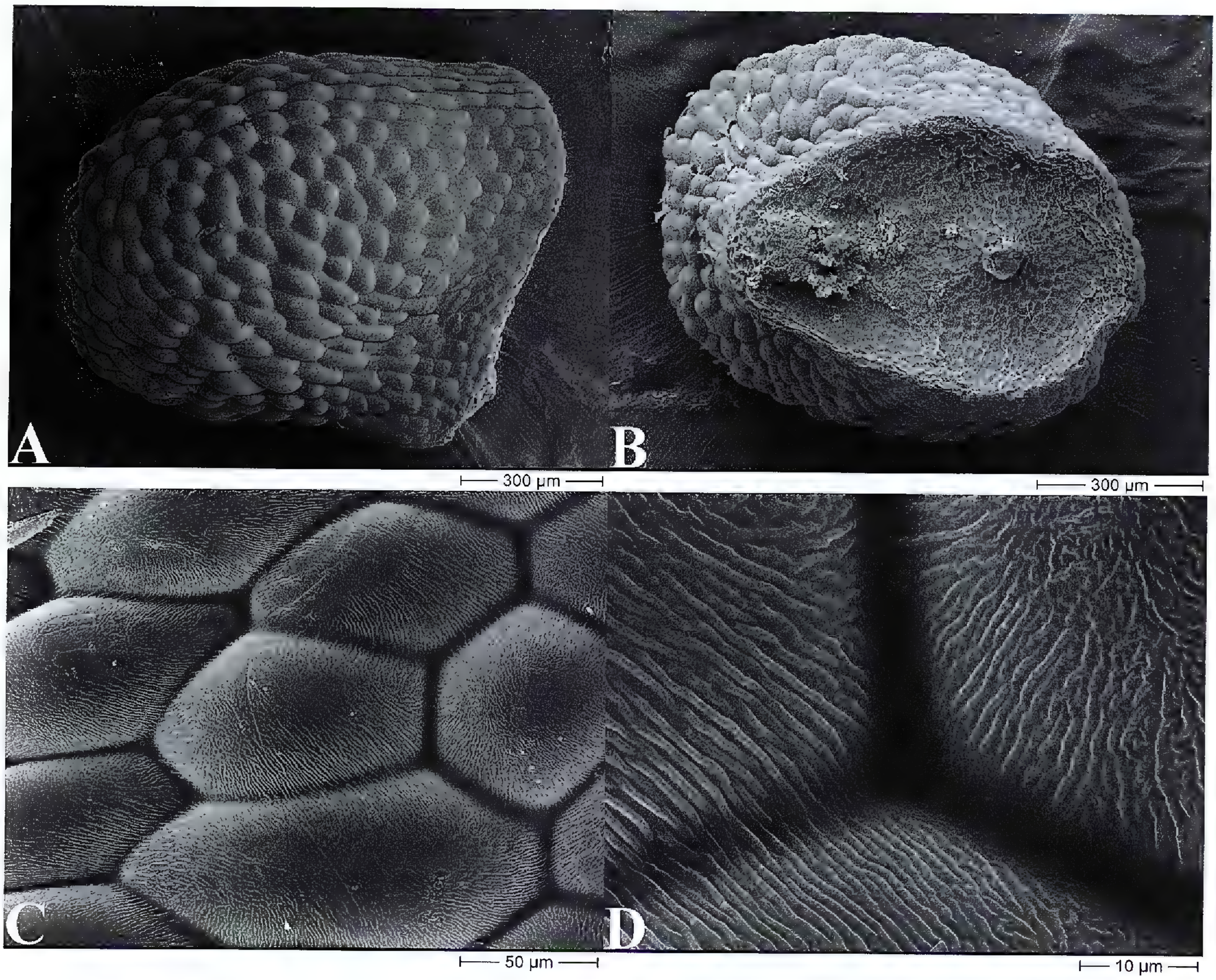

Figure 2. Seeds of *Parodia gaucha* M. Machado & Larocca. —A. Lateral view. —B. Hilum-micropylar region. —C. Testa-cell surfaces, displaying minutely striated cuticular folding patterns. —D. Close-up of the striations of the testa-cell surface. From the holotype *M. Machado 865* (ZSS).

state of Rio Grande do Sul; this epithet is in accordance with ICBN Art. 23.2 (McNeill et al., 2006).

Systematic relationships. *Parodia gaucha* belongs to the *P. ottonis* group by virtue of producing offsets on short stolons and having fruits with a thick and fleshy pericarpel that dehisces by longitudinal slits. It is morphologically similar to the other many-ribbed species of this group, *P. muricata*, *P. stockingeri*, and *P. tenuicylindrica*. The species that most closely resembles *P. gaucha* is *P. muricata*, but the latter can be distinguished from the former by the following suite of characters: absence of a conical projection below each areole; lower number of ribs (only to 18), which are wider and higher than the ribs of *P. gaucha*; areoles that are less closely spaced; smaller number of spines (only to 18 including central and radial spines); spines of different color; and seeds with smooth testa-cell surfaces (Table 1). *Parodia stockingeri* shares with *P. gaucha* the presence of a conical projection below each areole, but it is a smaller plant with a lower number of ribs and spines, and it has seeds with a smooth testa-cell surface (Table 1). *Parodia tenuicylindrica* differs from all other species of the *P. ottonis* group by producing hooked central spines; it differs from *P. gaucha* due to its smaller size, absence of a conical projection below each areole, the lower number of ribs and spines, and different color of the spines (Table 1).

Parodia gaucha is geographically well separated from the other similar species of the *P. ottonis* group. *Parodia muricata* occurs in southwestern Rio Grande do Sul, Brazil, where it is known from a number of localities around the municipality of Jaguari. The nearest populations of *P. muricata* are separated from *P. gaucha* by over 250 km. *Parodia stockingeri* also occurs in southwestern Rio Grande do Sul, Brazil, where it is known from a handful of localities southeast of the village of Unistalda, municipality of Santiago. It is separated from *P. gaucha* by over 320 km. *Parodia tenuicylindrica* occurs in southwestern Rio Grande do Sul, Brazil, and northwestern

Table 1. Comparison of morphological characters of species of the *Parodia ottonis* group.

	P. gaucha	*P. muricata*	*P. stockingeri*	*P. tenuicylindrica*
Body diameter (cm)	to 8	to 10	to 4	to 4
Shape of body	clavate to short-cylindric	globose to short-cylindric	clavate to cylindric	clavate to cylindric
No. of ribs	18 to 22	16 to 18	12 to 15	13 to 21
Height of rib (mm)	2–4	6–8	3–5	2–4
Width of rib (mm)	6–10	10–14	4–8	4–6
Distance between areoles (mm)	3–4	6–10	3–4	1.5–3
No. of central spines	6	3 or 4	4	2 to 4
Color of central spines	yellow to orange-red	reddish brown	yellow to orange-red	reddish brown to black
No. of radial spines	18 to 26	10 to 14	10 to 16	10 to 16
Color of radial spines	yellow	glassy white	cream-yellow to yellow	cream-yellow to yellow
Testa-cell surface of seeds	minutely striated	smooth	smooth	minutely striated

Uruguay. The distribution of this species in Brazil is restricted to the area around and between the municipalities of Santana do Livramento and Quaraí in Rio Grande do Sul, with the northern limit south of the municipality of Alegrete; in Uruguay, the species is distributed in the area around and between the municipalities of Rivera and Artigas, with the southern limit north of the municipality of Tacuarembó. The nearest populations of *P. tenuicylindrica* are separated from *P. gaucha* by over 260 km.

Superficially, *Parodia gaucha* is reminiscent of yellow-spined forms of *P. scopa* (Sprengel) N. P. Taylor, but the latter is clearly distinguishable from *P. gaucha* because it has a higher number of ribs (24 to 40) and radial spines (36 to 40 or more), flowers with stamens lacking a reddish color at the base of the filaments, smaller fruits with a thin pericarpel that becomes papery and disintegrates after drying, and seeds with testa-cell surfaces displaying larger striate cuticular folding patterns (Glaetzle & Prestlé, 1986). Moreover, offsets of *P. scopa* are not produced on short stolons nor developed underground, characteristics that are synapomorphic for the *P. ottonis* group. Furthermore, *P. scopa* belongs to a clade distinct from that of the *P. ottonis* group (Nyffeler, 1999; Machado et al., in prep.).

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Three New Varieties of *Packera paupercula* (Asteraceae, Senecioneae) in Midwestern and Southeastern North America

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Abstract. We describe two new varieties of the North American species complex *Packera paupercula* (Michaux) Á. Löve & D. Löve (Asteraceae, Senecioneae): variety *savannarum* R. R. Kowal from the American upper Midwest and variety *appalachiana* A. M. Mahoney from the southeastern United States. The new combination *P. paupercula* var. *pseudotomentosa* (Mackenzie & Bush) R. R. Kowal from the Midwest is also established. Because of their pubescence, these varieties have been previously included within a broadly circumscribed *P. plattensis* (Nuttall) W. A. Weber & Á. Löve. Their recognition is based on a biosystematic study, which included morphological and ecological observations in the field and in a transplant garden experiment, and chromosome counts.

Key words: American Midwest, Asteraceae, *Packera*, Senecioneae, southeastern United States.

The genus *Packera* Á. Löve & D. Löve (Asteraceae, Senecioneae) is notorious for its morphologically variable and intergrading populations, hybrids, and regional, ecotypic, and cytological races (Fernald, 1943; Barkley, 1962; Kowal, 1975; Uttal, 1982; Bain & Jansen, 1995; Bain & Golden, 2000). Members of the genus have chromosome numbers based on $x = 22$ and $x = 23$ with diploid, tetraploid, pentaploid, hexaploid, and octaploid individuals, species, races, and/or populations reported (Kowal, 1975; Morton, 1981; Bain, 1985; Freeman, 1985; Kowal, unpublished data). Many *Packera* taxa are identified primarily by vegetative characters, such as pubescence, number and distribution of cauline leaves, and leaf shape, texture, and toothing. Mode of asexual reproduction is an underutilized character that is often critical for identifying *Packera* taxa.

The *Packera paupercula* (Michaux) Á. Löve & D. Löve complex constitutes the most widespread and polymorphic of the *Packera* species. This principally cold-temperate assemblage occurs across Canada as far north as the Arctic Circle, from Newfoundland to southern Alaska (Hultén, 1968; Porsild & Cody, 1980; Rouleau & Lamoureax, 1992; Cody, 1996; Trock, 2006). In the U.S.A., *P. paupercula* occurs in the Rocky Mountains south through Colorado, the Midwest, and the Northeast. It is absent south of the Columbia River Gorge in the extreme West and from the southwestern deserts and the Great Plains, except for isolated populations in the Black Hills of South Dakota. It occurs sporadically in the southeastern U.S.A. (Uttal, 1983).

Packera paupercula, as currently delimited, contains diploid and tetraploid cytological races (Kowal, 1975; Morton, 1981; Freeman, 1985; Kowal, unpublished data). Most populations have a base chromosome number of 22, but in western Canada populations with $x = 23$ also occur (Morton, 1981; Bain, 1985). Barkley (1962) described two varieties of *P. paupercula*: the widespread, polymorphic variety *paupercula*, and the rare endemic of eastern bogs and floodplains, *Senecio pauperculus* var. *crawfordii* (Britton) T. M. Barkley. Although he later chose not to recognize the latter variety (Barkley, 1978), our observations suggest that the taxon merits recognition at the species level (Mahoney & Kowal, unpublished data). Western populations tend to be larger-headed than eastern populations and have sometimes been recognized as *S. pauperculus* var. *thomsoniensis* (Greenman) B. Boivin (Cronquist, 1955). Because Barkley (1962) observed that head size increases gradually in *P. paupercula* from east to west and found no other characters with which to consistently distinguish the variety, he chose not to recognize it.

Barkley (1962, 1978) described *Packera plattensis* (Nuttall) W. A. Weber & Á. Löve as a more or less permanently pubescent species occurring in prairie or prairie-like habitats throughout the Great Plains, west to Montana, Wyoming, and Colorado, south to Arkansas and central Texas, and east to Illinois, northern Indiana, Michigan, and southwestern On-

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tario. He reported populations from isolated sites in the Great Slave Lake area of the Northwest Territories, central Manitoba, southern Ohio, Tennessee, North Carolina, and Virginia (Barkley, 1962, 1978). Barkley's circumscription of *P. plattensis* included "several ill-defined phases...recognized by a series of morphological tendencies" that he did not consider distinctive enough for formal recognition (Barkley, 1962: 379). He hypothesized that populations from the uplands of Tennessee, North Carolina, and Virginia were relicts of the migration of *P. plattensis* through the prairie peninsula during the warm, dry hypsithermic period sometime between 9000 and 4000 years before present (Wright, 1968; Barkley, 1988). He described a second series of populations that intergrade morphologically, suggesting introgressive hybridization between *P. plattensis* and *P. paupercula* from Wisconsin and southern Minnesota south to northern Missouri (Barkley, 1962, 1963). A third group of populations, his "stoloniferous phase" (Barkley, 1962: 379), produces new rosettes from the tips of long, unbranched, slender, pale, underground stolons and occurs in sandy to rocky habitats from the Ozarks east through the Prairie Peninsula to Ohio. Our new varieties correspond to these three phases.

Twenty-five chromosome counts from typical *Packera plattensis*, excluding Barkley's (1962) phases, from Great Plains populations in Kansas (17 counts), Minnesota (2), Nebraska (1), North Dakota (2), and Wyoming (1) indicate these populations are tetraploid with a base chromosome number of 23 ($2n = 92$); counts on plants with typical Great Plains morphology from two Wisconsin populations give the same results (Kowal, 1975; Freeman, 1985; Kowal, unpublished data). However, counts on individuals from populations representing Barkley's (1962: 379) "ill-defined phases" of *P. plattensis* have base numbers of 22 and are largely diploid with $2n = 44$; a few tetraploid populations have $2n = 88$.

Thus, cytological evidence supports recognition of these more or less pubescent phases—or races—from central and eastern North America with chromosome numbers based on $x = 22$ as something other than typical *Packera plattensis*. Differences in base chromosome and ploidy numbers also preclude widespread introgression between these races and *P. plattensis*. Examination of herbarium material and observations in the field and in five transplant gardens at the University of Wisconsin–Madison (1972–1984, 1974–1983, 1982–1995, 1995–2002, and 2002–present) indicate that these races also differ in habitat requirements and vegetative morphology. In the few areas where the Midwestern savanna race occurs within pollinating distance of *P. plattensis*, it occupies more mesic habitats. Because the three races have the same base number ($x = 22$) as typical *P. paupercula* and are morphologically similar to it, we describe them under this single species as varieties.

Our new varieties differ in their means of asexual reproduction. The variety from the southern Appalachians (comprising Barkley's putative hypsithermic-period relicts) reproduces by thick, dark, horizontal rhizomes with short internodes that branch laterally to produce compact clones. With the death of older rhizomes, a clone splits into two or more individuals. Such asexual reproduction also characterizes *Packera aurea* (L.) Á. Löve & D. Löve, *P. pseudaurea* (Rydberg) W. A. Weber & Á. Löve var. *pseudaurea*, and *P. schweinitziana* (Nuttall) W. A. Weber & Á. Löve. The Midwestern savanna variety (representing at least some of Barkley's hypothesized introgressants) forms shoots adventitiously on its roots. Proliferation of cells at a point along a root forms callus tissue from which a stem differentiates and grows to the surface where it forms a single vegetative rosette. Because these stems are vertical and do not serve as perennating organs, they are not rhizomes. Such asexual reproduction, sometimes producing clones more than a square meter in area, appears sporadically in many taxa, e.g., hexaploid *P. aurea* (Kowal, 1975), and seems to be especially frequent in hybrid individuals (Kowal, 1975, pers. obs.). However, in some taxa, such as *P. plattensis* and *P. pseudaurea* var. *flavula* (Greene) Trock & T. M. Barkley and var. *semicordata* (Mackenzie & Bush) Trock & T. M. Barkley, asexual shoots on roots are the only mode of forming clones. Our third variety, from the American Midwest to Missouri and Arkansas, comprises Mackenzie and Bush's (1902) *Senecio pseudotomentosus* and Barkley's (1962) stoloniferous phase of *P. plattensis*. We employ the term underground stolon to differentiate these very distinctive organs from typical rhizomes. Underground stolons also occur in *P. hartiana* (A. Heller) W. A. Weber & Á. Löve, *P. obovata* (Muhlenberg ex Willdenow) W. A. Weber & Á. Löve, and *P. tomentosa* (Michaux) C. Jeffrey.

1. Packera paupercula (Michaux) Á. Löve & D. Löve, Bot. Not. 128: 520. 1975 [1976]. Basionym: *Senecio pauperculus* Michaux, Fl. Bor.-Amer. 2: 120. 1803. TYPE: Canada. Quebec: by the side of Lake St. Jean, Aug. 1792 (Brunet, 1864), *A. Michaux s.n.* (holotype, P not seen, photo GH; isotypes, P [2] not seen, photos WIS).

1a. Packera paupercula (Michaux) Á. Löve & D. Löve var. **paupercula**

1b. Packera paupercula var. **appalachiana** A. M. Mahoney, var. nov. TYPE: U.S.A. North Car-

olina: Madison Co., Hot Springs, 3.2 mi. W along Paint Rock Rd. (Co. 1304) from Hwy. 25–70, 29 Apr. 2002, *D. H. Warren & W. D. Warren 1* (holotype, WIS; isotypes, BRIT, F, GH, MO, NCU, NY, USA).

Inter proles et varietas speciei *Packerae pauperculae* (Michaux) Á. Löve & D. Löve flosculis radii, involucris et phyllariis brevibus ad *P. anonymum* (Wood) W. A. Weber & Á. Löve accedens. Varietas habitu cum *P. plattensi* (Nuttall) W. A. Weber & Á. Löve et prolibus et varietibus allopatricis Medioccidentalis americanis *P. pauperculae* pubibus et foliis rosularibus brevis ovatis ad obovatis optime congruens, sed differt a sympatricis austro-orientalis speciei quae glabrae sunt et foliorum rosularium lanceolatorum habent.

Herbaceous perennials (hemicryptophytes), reproducing asexually by dark, horizontal, sometimes adsurgent rhizomes (mostly 1–3 cm × 1.5–2+ mm diam.), at or just below the ground (rarely adventitious shoots on roots present in addition); *stems* (2.5–)4–6 dm. *Leaves* firm-textured, medium green, persistently lightly arachnoid to tomentose, sometimes glabrate; *rosette leaves* petiolate, (6–)8–13.5(–27) × (0.8–)2–3(–5) cm; blades typically shorter than or equal to petioles, broadly elliptic to elliptic-oblong to obovate to nearly round, bases attenuate, cuneate, truncate to acute, rarely subcordate, apices usually rounded, margins shallowly crenate, dentate or bidentate, sometimes with a few slender basal lobes; *proximal cauline leaves* petiolate, 3–7 × (0.7–)1–2 cm; *mid to distal cauline leaves* sessile, gradually reduced distally, (3.5–)6–10(–13) × 1–2(–3.7) cm; blades narrowly triangular to pandurate, usually pinnately divided proximally or throughout (segments of the divided portion and marginal teeth usually regular, symmetrical to sometimes irregular, asymmetrical), apices obtuse to round or acute. *Inflorescence* a corymbiform cyme, heads 7 to 19 in primary terminal cyme; sometimes with long lateral branches from proximal nodes; *involucres* (4.8–)5–7(–8.4) × 3–4 (–4.8) mm, phyllaries 18 to 29, 4–6 mm. *Florets* 50 to 80, ray florets 10 to 17, laminae (4.5–)5–7(–9.4) × 1.7–3.3 mm; ovaries at anthesis 1.6–2.8 mm. Achenes hirtellous or glabrous.

Distribution and ecology. *Packera paupercula* var. *appalachiana* is confined to dry sites in gravelly or rocky soil in cedar glades and on river bluffs, wooded slopes, limestone and dolomite ledges, and roadsides in the southern Appalachian Mountains of West Virginia, Virginia, North Carolina, and Tennessee (Mahoney et al., 2002: fig. 1).

Phenology. Flowering in April and May.

Etymology. The epithet refers to the Appalachian Mountains, where it is endemic.

Cytology. Of the two populations studied, Paint Rock Road (North Carolina, Madison Co.) is diploid with $n = 22$, and Lover's Leap (Virginia, Montgomery Co.) is tetraploid with $n = 44$ (Mahoney et al., 2002).

Discussion. *Packera paupercula* var. *appalachiana* is geographically isolated from variety *savannarum*, variety *pseudotomentosa*, and *P. plattensis* s. str. and differs from them in means of asexual reproduction, producing rhizomes, as in the autonymic variety *paupercula*. However, variety *paupercula* only rarely occurs south of Pennsylvania and typically occurs in wet to mesic habitats. At its southeastern limit, variety *paupercula* is glabrous to glabrate and has narrowly elliptic-lanceolate, acute-tipped leaf blades. Variety *appalachiana*, in contrast, is pubescent and has broadly elliptic rosette leaf blades with blunt tips and more abruptly contracted bases; it also has shorter involucres, phyllaries, rays, and ovaries than variety *paupercula* and more commonly produces long branches from the proximal nodes of the main stem.

Paratypes. U.S.A. **North Carolina:** Madison Co., above French Broad River, 1.5 mi. E of TN line on Co. 1304, *J. R. Massey & D. E. Boufford 3942* (NCU), 3.2 mi. W of US rte. 25–70 on Co. 1304, *D. E. Boufford 12699* (GH), near Hot Springs, 3.2 mi. NW along Paint Rock Rd. from Hwy. 25–70, *R. R. Kowal & A. M. Mahoney 3120* (WIS). **Tennessee:** Knox Co., Knoxville, *A. Ruth 703* (MO), near Knoxville, *A. Ruth 4211* (NCU, NY); Montgomery Co., Trice's Landing on Cumberland River W of Clarksville, *E. W. Chester 81-65* (APSC). **Virginia:** Frederick Co., Cedar Creek, *F. W. Hunnewell 12445* (GH), U.S. 11, 2 mi. S of Middleton, *L. J. Uttal 6429* (GH); Montgomery Co., 2 mi. SE of Ellett, *R. Kral 10233* (NCU), along roadside near Price's Fork at Lover's Leap, *A. B. Massey 2966* (MO), 2 mi. W from Price's Fork on McCoy Rd. (Rte. 652), Lover's Leap, *R. R. Kowal & A. M. Mahoney 3123* (WIS), VA 603, 2 mi. NW of Montgomery Community, *L. J. Uttal 6472* (GH, NCU), entrance to [Beach] Ravine, VA 642, ca. 0.5 mi. W of Ellett, *L. J. Uttal* (GH, NCU), N side of VA 652 at Lover's Leap near Price's Fork, *L. J. Uttal 6833* (GH), VA 628 at old Slusser Bridge E of Blacksburg, *L. J. Uttal 6515* (GH, NCU), Pedlar Hills, Rte. 636, 1 mi. W of 637, *L. J. Uttal 10354* (NCU); Roanoke Co., along Roanoke River at Dixie Caverns, *C. E. Wood Jr. 5786, 5787, 5788, 5791, 5794, 5795* (GH, NCU), bluff of Roanoke River opposite Dixie Caverns (US 11), *L. J. Uttal 6411* (GH, NCU); Shenandoah Co., near Strasburg, SE corner of VA 55 & 794, *L. J. Uttal 6434* (GH, PH); Surry Co., NE of Dendron, *M. L. Fernald, B. Long & E. C. Abbe 14244* (GH). **West Virginia:** Hardy Co., Getz Mountain Prairie, E slope of Getz Mtn. at head of Dumpling Hollow, *R. L. Bartgis 1253* (PH).

1c. Packera paupercula var. **savannarum** R. R. Kowal, var. nov. TYPE: U.S.A. Wisconsin: Grant Co., bluff NE of corner of Rte. 133 & Sand Lake Lane near Cassville, 4 June 2002, *R. R. Kowal 3197* (holotype, WIS; isotypes, BRIT, CAN, F, GH, MO, NCU, NY, RM, UC, USA).

Differt a prolibus et varietatibus speciei *Packerae pauperculae* (Michaux) Á. Löve & D. Löve paene solum rhizomatibus absentibus et reproductionibus ab surculis ex radicibus, aliquando clonem grandes faciens; pubibus ± permantibus sparsis ad densis, coloribus prasinis pallidibus, foliis mollibus, languescenibus celeriter ad marginibus revolutis ubi lectus; foliis rosularibus brevis, laminis ovatis, basibus truncatis ad acutis; foliis caulinis asymmetricis, pinnatifidis ad basibus ac integis ad apicibus.

Herbaceous perennials (hemicryptophytes), reproducing by adventitious shoots on roots (often abundantly), not producing rhizomes; *stems* (2.5–)3–5.5(–8) dm. *Leaves* pale green, rarely, if ever, anthocyanic abaxially, pubescent to sometimes glabrate, soft-textured, quick to wilt upon collection with margins becoming revolute; *rosette leaves* petiolate, (7.5–)10–15(–17.5) × 2–3.5 cm; blades typically shorter than or equal to petioles, narrowly to broadly ovate to elliptic, sometimes narrowly obovate, bases truncate to acute, apices rounded to obtuse, margins shallowly dentate; *proximal cauline leaves* petiolate, similar to rosette leaves, (2–)3–9 × 0.8–1.5(–2); *mid to distal cauline leaves* sessile, (1.5–)2.2–6(–13.4) × (0.3–)0.5–1.5(–2) cm, narrowly triangular to pandurate, usually pinnately divided proximally and unlobed distally (segments of the divided portion and marginal teeth often irregular, remote, asymmetrical, ragged in appearance), apices ± narrowly acuminate. *Inflorescence* a congested to open corymbiform cyme with (5)6 to 12(14) heads in the primary terminal cyme; *involucres* (5–)6–9(–12.3) × 4–5(–5.9) mm, phyllaries 18 to 22, (4–)4.5–6(–8.4) mm. *Florets* (65)80 to 100(118), ray florets (10)12 to 16(18), laminae (5–)6–8(–9.4) × 1.6–2.4(–2.7) mm; ovaries at anthesis (1.3–)1.8–2.8(–3.3) mm. Achenes hirtellous or glabrous.

Distribution and ecology. *Packera paupercula* var. *savannarum* occurs in mesic prairies, savannas, and open woodlands and woodland margins in Iowa, southeastern to south-central Minnesota, southern Wisconsin and Michigan, and northern Illinois. The variety is restricted to the American upper Midwest.

Phenology. Flowering in May.

Etymology. The variety is named for the savanna habitats in which it commonly occurs.

Cytology. *Packera paupercula* var. *savannarum* is diploid with $n = 22$, based on 26 counts from Iowa (4) and Wisconsin (22) (Freeman, 1985; Kowal, unpublished data).

Discussion. Like *Packera plattensis*, variety *savannarum* reproduces asexually by adventitious shoots on roots but differs in having a shallower, more easily seen, much-branched root system that commonly gives rise to large clones. Unlike *P. plattensis*, its praemorse caudices bear fibrous roots that are typically neither dense nor fleshy. The blades of its rosette and proximal cauline leaves are soft-textured, wilting quickly upon collection, and pale to bright green, rarely flushed with purple abaxially; they are only rarely lobed. Its cauline leaves are usually numerous and quickly reduced in size up the stem, with the ones just beneath the inflorescence often mere bracts. The middle ones are commonly pinnatifid only near the base with their tips unlobed; their segments and teeth are often irregular, remote, and asymmetrical, giving the leaf a ragged appearance. There is some tendency for the peduncles of the inflorescence to be erect rather than spreading.

Paratypes. U.S.A. **Illinois:** Champaign Co., near Urbana, grassy bank, *G. N. Jones 11388* (BRIT), 2 mi. E of Urbana, roadside, clay soil, 1950, *K. S. Storm s.n.* (BRIT); Grundy Co., W side of Hwy. 53, 5.6 mi. S of 113, *A. M. Mahoney 295* (WIS), Hwy. 129 at S Mitchell Rd. & railroad tracks, *A. M. Mahoney 299* (WIS); Henry Co., N of Annawan, *V. H. Chase 12329* (MICH); Stark Co., Valley Township, *V. H. Chase 4204* (WIS); Winnebago Co., near S Beloit, *P. Hoge 5* (WIS). **Iowa:** Allamakee Co., ca. 0.2 mi. SW of the jct. of Allamakee Co. X42 & X52, SW of Harpers Ferry, *C. C. Freeman 2360* (KSC); Black Hawk Co., N of Cedar Falls, 1932, *B. Shimek s.n.* (MO); Bremer Co., Co. Hwy. C38, 0.7 mi. S of jct. with C33 in Bremer, *C. C. & J. A. Freeman 2221* (KANU, KSC, MEXU, NY, WET, WIS), Cedar Bend Conservation Park, ca. 1.5 mi. NNW of Waverly, E end of park, *C. C. Freeman 3098* (BRIT); Butler Co., T47 at the NW corner of bridge over W fork of the Cedar River, *C. C. & J. A. Freeman 2225* (KANU, KSC, MEXU, NY, WET, WIS); Clayton Co., 1.6 mi. W of Marquette along Hwy. 18, 0.35 mi. S of Bloody Run, *R. R. Kowal 3080* (WIS); Iowa Co., S of Amana, 1922, *B. Shimek s.n.* (WIS); Jones Co., field 2 mi. E of Cascade on Hwy. 151, *N. Bushnell 14* (WIS); Louisa Co., colony in low sandy prairie remnant, *R. A. Davidson & T. S. Cooperrider 4117* (BRIT); Scott Co., Credit Island, Davenport, *Anonymous 2707b* (WIS). **Michigan:** Kalamazoo Co., Ross Township, T1S R9W sec. 6, edge of swale, *G. W. Parmelee 3170* (WIS). **Minnesota:** Houston Co., 5.5 mi. down the Winnebago Valley, *J. W. Moore & E. Itsi 27146* (MIN); Mower Co., T101N, R14W, sec. 21, SW 1/4, SE 1/4, *R. G. Nation 94-022* (MIN). **Wisconsin:** Crawford Co., Haney Township, Citron Valley, R. Zinkle's property, The Hogback, *R. R. Kowal 3202* (WIS); Dane Co., Black Earth Township, SW of county KP, Lucy Farm, *R. R. Kowal 2867* (WIS), Cross Plains, DNR Wildlife Area, jct. of Cleveland & Old Sauk Pass Rds., SE corner, *R. R. Kowal 2873 & 2874* (WIS), NE of Cross Plains, 1957, *Bokde, Gabert & Kempen s.n.* (BRIT), Madison, Univ. of Wisconsin Arboretum, N of Greene Prairie, Grady Tract, 1945, *H. C. Greene s.n.* (WIS), Oregon Township, T5N R9E sec. 29 NE3, *R. R. Kowal 1589* (WIS), S of Rte. 12 & just W of county W, Lavern Peterson Farm, T7N R12E sec. 31 central 1/9, *R. R. Kowal 1580* (WIS); Grant Co., NNW of Montfort, Isolation Prairie, DNR property, *R. R. Kowal 3074* (WIS), S of Woodman, SW of Green River & Green River School, *R. R. Kowal 1501, 2880, 2881, 2882* (WIS); Green Co., SW of Albany, N of Rte. 59 across from Gap Church, ridge on whose NE slope is Abraham's Woods, *R. R. Kowal 1487–1491, 2883, 2884, 2887* (WIS), SE of New Glarus, 0.8 mi. S of Exeter Crossing Rd. & Marshall Bluff Rd. (Exeter), *A. M. Mahoney 582*

(WIS); ca. 2.5 mi. E of Albany, S of Rte. 39, Muralt Bluff Res., *A. M. Mahoney 583* (WIS); Iowa Co., Dodgeville, N of Governor Dodge State Park, Robert E. Forbess Farm, T7N, R3E, sec. 34, NW3, *R. R. Kowal 2872* (WIS); Jefferson Co., ca. 4 mi. E of Cambridge, savanna on hillsides facing Red Cedar Lake, *R. R. Kowal 1583, 1584* (WIS); Lafayette Co., open, formerly pastured slope above county M, T2N, R5E, sec. 24, SW3, NE3, *R. R. Kowal 2890, 2892* (WIS); Richland Co., 3 mi. SE of Richland Center, Harry Nee Farm, *R. R. Kowal 2894, 2896* (WIS); Rock Co., 4.5 mi. NW of Beloit, Paddock Rd., Beloit 7.5′ quadrangle, *S. R. Hill 26531* (BRIT), Spring Valley Township, NE of jct. of Keesey & Dickey Rds., *R. R. Kowal 2897* (WIS); Trempealeau Co., Perrot State Park, at base of Brady's Bluff, rd. shoulder, *R. R. Kowal 2862, 3201* (WIS).

1d. Packera paupercula var. **pseudotomentosa** (Mackenzie & Bush) R. R. Kowal, comb. et stat. nov. Basionym: *Senecio pseudotomentosus* Mackenzie & Bush, Trans. Acad. Sci. St. Louis 12: 88. 1902. TYPE: U.S.A. Missouri: Shannon Co., Monteer, 13 May 1901, *B. F. Bush 453* (holotype, MO; isotype, NY [fragment; Barkley, 1962]).

Herbaceous perennials (hemicryptophytes), reproducing by long, slender, pale underground stolons, mostly 3–16 cm × 0.7–1.2(–1.8) mm diam.; *stems* (2.3–)3–4(–7.3) dm. *Leaves* firm-textured, pale green to hoary, lightly to densely arachnose-floccose to tomentose, sometimes glabrate; *rosette leaves* petiolate, 6–11(–17.2) × (1.5–)2–3.6(–4.9) cm; blades typically shorter than or equal to petioles, broadly elliptic to ovate to nearly round, bases truncate to rarely cordate, apices rounded to ± truncate, margins coarsely to shallowly serrate to crenate; *proximal cauline leaves* petiolate, 2.5–4.5(–7) × (0.5–)1–1.6 cm; blades elliptic to ovate to obovate, bases acute to truncate to rarely cordate, apices obtuse to rounded; *mid to distal cauline leaves* sessile, gradually reduced distally, (1.2–)3–5(–10) × (0.2–)0.8–1.2(–3.7) cm; blades triangular, sometimes pandurate, pinnately divided proximally and usually unlobed distally (segments of the divided portion and marginal teeth usually regular, symmetrical), apices blunt to acute. *Inflorescence* a corymbiform cyme, heads 7 to 10 in primary terminal cyme; rarely with long lateral branches from proximal nodes; *involucres* (6–)9.1 × 4.6(–5.6) mm; phyllaries (3.5–)4–5(–6.6) mm. *Florets* 80 to 123; ray florets 11 to 21, laminae (5.8–)7.8 × 1.7(–2.1) mm; ovaries at anthesis 1.6–2.6 mm. Achenes hirtellous or glabrous.

Distribution and ecology. *Packera paupercula* var. *pseudotomentosa* is found in dry sandy, or gravelly to rocky soils in grasslands, barrens, savannas, wooded bluffs, and dunes from northernmost Arkansas and Missouri through Iowa and Illinois to Wisconsin, the lower peninsula of Michigan and adjacent Ontario, Indiana, and south-central Ohio. It appears to be absent from Minnesota and north of the tension zone in Wisconsin.

Phenology. Flowering in May.

Etymology. Mackenzie and Bush (1902) implied that their taxon had been mistakenly referred to *Packera tomentosa* (as well as to *P. plattensis*), hence their epithet *pseudo-tomentosus*. It resembles *P. tomentosa* in producing stolons and in sometimes having the large, broadly elliptic, densely tomentose rosette leaves of that species.

Cytology. Two populations of *Packera paupercula* var. *pseudotomentosa* (one each from central Wisconsin and southern Michigan) are diploid with $n = 22$ (Kowal, unpublished data); a third from Iowa was reported as $2n = 23$ II, but the accompanying camera lucida drawing indicates that this is an approximate count with $2n = 22$–23 II (Freeman, 1985); and one population from north-central Michigan (Otsego Co.) is approximately tetraploid (Mahoney, 2000).

Discussion. Variety *pseudotomentosa* reproduces asexually by shallow underground stolons that clearly distinguish it from *Packera plattensis* and all other members of the *P. paupercula* complex. Like *P. plattensis*, it tends to have few cauline leaves that are only gradually reduced in size up the stem, but the middle ones are commonly unlobed distally. Our study of living populations and herbarium specimens indicates that populations in Missouri tend to be more robust and to have more highly divided cauline leaves. However, given that all produce stolons and are persistently pubescent, we treat them together and use the earliest available epithet, Mackenzie and Bush's (1902) *pseudotomentosus*, at the rank of variety.

Paratypes. CANADA. **Ontario:** Kent Co., Orford Township, Moravian Indian Res. 47, on S side of Thames River, 6 km ENE of Thamesville, *A. A. Reznicek & H. J. Oldham 7895* (MICH); Lambton Co., 2 mi. S of Grand Bend, *J. A. Gillette & H. A. Senn 9926* (WIS), Point Edward, 1897, *C. K. Dodge s.n.* (MICH), Port Franks, 1904, *C. K. Dodge s.n.* (MO), Port Franks, 1910, *C. K. Dodge s.n.* (MICH), Port Franks, *C. K. Dodge 108* (F), Sandwick, *J. Macoun 16673* (NY), Sarnia, *C. K. Dodge 297* (NY); Middlesex Co., Adelaide Township, Sydenham River SW of Strathroy Sewage Lagoons, 3.3 km SW of Strathroy P.O., *M. J. Oldham 12484* (MICH), Caradoc Township, ca. 1 km W of Mt. Brydges on Co. Rd. 14, *M. J. Oldham 14811* (MICH), Lobo Township, Komoka Feed Mill Prairie, 1.3 km NE of Komoka P.O., *M. J. Oldham 12702* (MICH), McGillivray Township, 8.6 km NNE of Parkhill P.O., *M. J. Oldham & D. McLeod 10735* (MICH), W of Williams Township, 2.9 km WNW of Parkhill P.O., *M. J. Oldham 12519* (MICH). U.S.A. **Arkansas:** Fulton Co., ca. 2 mi. SE of Mammoth Spring, on U.S. 63 to Hardy, *H. H. Iltis et al. 21740* (WIS); Sharp Co., open hillside about 2 mi. N of Hardy, *I. Hartsoe 322* (BRIT),

along U.S. 63 ca. 9 mi. S of Hardy, *N. C. Henderson 95–112* (MO). **Illinois:** Mason Co., near Havana, *G. N. Jones 13423* (MO); Peoria Co., Horse Shoe Bottom overlook, *V. H. Chase 11774* (BRIT), off Rte. 116 ca. 4 mi. W of Peoria, *J. Matuda 296* (WIS), near Peoria, *J. T. Steward 16928* (WIS). **Indiana:** Allen Co., Godfroy Reserve ca. 3 mi. S of Ft. Wayne, *C. C. Deam 15841, 19845* (BRIT); Porter Co., Chesterton, *L. M. Umbach 11861* (WIS), Tremont, 1928, *M. W. Lyon Jr. s.n.* (MICH). **Iowa:** Adair Co., IA 92, 4.2 mi. W of Cass Co. line, *C. C. & J. A. Freeman 2226* (KANU, KSC, MEXU, NY, WIS). **Michigan:** Allegan Co., Valley Township, ca. 6 mi. WNW of Allegan, *E. G. Voss 6491* (MICH); Clare Co., 1900, *C. A. Davis s.n.* (MICH); Clinton Co., Rose Lake Wildlife Exp. Station, *H. D. McGinley R.L. 29* (MICH); Crawford Co., ca. 8 mi. SE of Lovells, T27N R1W sec. 26 near center, *E. G. Voss 14614* (LKHD, MICH); Hillsdale Co., ca. 12 km SW of Hillsdale off Reading Rd., 0.1 mi. E of Blair Rd., *P. Fritsch 1123* (MICH); Iosco Co., T23N R7E, *D. A. Zimmerman 147* (MICH), Huron Natl. Forest, *J. H. Ehlers 4758* (MICH), Wilber Township, N side of Gordon Creek, sec. 16 & 17, 1961, *A. J. Sharp, E. Sharp, M. J. Schneider & C. Varner s.n.* (MICH); Jackson Co., Jackson, 1893, *S. H. & D. R. Camp s.n.* (MICH), Jackson, *S. H. & D. R. Camp 42113* (MICH), *S. H. & D. R. Camp 1764* (MICH, WIS); Kalamazoo Co., Vicksburg, creek bank S of cemetery, *F. W. Rapp 2161–1* (MICH); Kent Co., Grand Rapids, *Kent Scient. Inst. 42111* (MICH), Grand Rapids, *E. J. Cole 50975, 50976, 50977, 50978* (MICH), Grand Rapids, Walker & Leonard, *C. W. Bazuin 5263* (MICH); Lenawee Co., Palmyra Township, NE of Shady Lane, N of Treat Hwy., *R. W. Smith 2466* (MICH), Woodstock Township, Onsted Game Area, W of Cleveland Lake, *R. W. Smith 3199* (MICH); Livingston Co., 3 mi. W [of] Pinckney, E. S. George Reserve, Hogsback, *F. N. Hamerstrom Jr. 479* (MICH), U. of Mich. Fresh Air Camp, *L. H. Jordal 1658* (MICH); Macomb Co., swamp N of Utica, 1917, *B. F. Chandler s.n.* (MICH); Manistee Co., Dickson Township, sec. 23, hillside above Manistee R., *B. Walters, C. Balie & W. & J. Harris 746* (MICH), Norman Township, S bank of Pine River, 0.92 mi. S of S.R. 55, 2002, *T. L. Walters & J. E. Schaeffer s.n.* (MICH); Mecosta Co., Aetna Township, ca. 3 mi. W of Morley, *E. G. Voss 3989* (MICH); Monroe Co., Ida Township, Todd Rd. at Secor Rd., *N. W. Easterly 11769* (MICH); Montmorency Co., Gingle Lake area, 1955, *F. & R. Case s.n.* (MICH); Newago Co., 8 mi. E of Grant, *F. F. Hermann 8688* (MICH), Brooks Township, *V. F. Brunnett 429* (MICH); Oakland Co., Royal Oak Township, 1916, *C. Billington s.n.* (MICH); Ogemaw Co., Cumming Township, ca. 4 mi. E of Rose City, Rifle River Area, *E. G. Voss 4157* (MICH); Oscoda Co., Mentor Township, ca. 3/4 mi. N of McKinley, S side of Russell Rd. (Co. Rd. 600), *D. Garlitz 787* (MICH), ca. 3 mi. NE of McKinley, *E. G. Voss 14572* (MICH); Otsego Co., ca. 7 mi. S of Johannesburg, *E. G. Voss 11507* (MICH), left fork of Caulkins Lake Rd. 0.55 mi. S from intersection with F38 (Old State Hwy.), *M. S. Mahoney 217* (WIS); St. Clair Co., near Port Huron, 1897, *C. K. Dodge s.n.* (MICH); St. Joseph Co., 2.4 mi. E of center of White Pigeon, *R. R. Kowal 2860* (WIS); Washtenaw Co., Ann Arbor, near Huron R., 33 mi. SE, *F. J. Hermann 6808* (MICH), Ann Arbor, Wagner Rd., 3.5 mi. NW, *F. J. Hermann 7441* (MICH), Bush Rd., Waterloo Nature Center, *M. R. Penskar 1026* (MICH), NE of Chelsea, near West Lake, *E. W. Erlanson & F. Hermann 5034* (MICH), Ypsilanti, 1918, *N. A. Harvey s.n.* (MICH), vic. Ypsilanti, Cady Swamp, 1920, *N. A. Harvey s.n.* (MICH); Wayne Co., Inkster, *O. A. Farwell 9062* (MICH), Livonia Township, NE part of S 29, 1936, *M. S. Schmidt s.n.* (WIS), Romulus, Detroit Metro. Wayne Co. Airport, *W. W. Brodowicz 900* (MICH). **Missouri:** Butler Co., Hwy. O near jct. with Co. Rd. 502A, 1993, *S. Hudson* (MO); Crawford Co., Meramec State Park, 3 mi. S of Sullivan on State Hwy. 185, *C. Dietrich & G. Mattingly 325* (MO); Jefferson Co., Kimmswick from Mt. Right of Way, 1915, *J. A. Drushel s.n.* (MO); St. Francis Co., near Bismark, 1893, *H. Eggert s.n.* (MO); Wayne Co., Cedar Bluff, Greenville, *S. Hudson s.n.* (MO). **Ohio:** Adams Co., Beaver Pond, 1927, *E. L. Braun s.n.* (MO); Brown Co., 2 mi. E of Aberdeen, *F. Bartley 1254* (NY), Old State Rd., 2 mi. E of Balcony Hills Rd., E of Aberdeen, Huntington Township, *A. W. Cusick 26295* (NY); Hocking Co., Rte. 56 at Haynes P.O., *F. Bartley 2482* (NY). **Wisconsin:** Adams Co., SW of Westfield, Lawrence Creek Hunting Ground, ca. 0.5 mi. W of Marquette Co. line, *R. R. Kowal 2848, 2850* (WIS); Marquette Co., ca. 6 mi. NNW of Westfield, David & Shelly Hamel Prairie, *R. R. Kowal 3241* (WIS), ca. 6.5 mi. NNW of Westfield, S of Dakota Dr., Pockrandt Quarry, *R. R. Kowal 3240* (WIS); Monroe Co., Ft. McCoy, E side Burma Rd. 0.5 mi. N of gate 18A, *A. M. Mahoney 596* (MANK, WIS); Portage Co., Whiting, Whiting Park, *R. W. & S. K. Freckmann 10514* (UWSP); Wood Co., SSE of Wisconsin Rapids, E of Nepco Lake, 1998, *A. Bogdansky s.n.* (UWSP).

Discussion

The populations treated as *Packera plattensis* and *P. paupercula* form a complex that ranges through North America, with the exception of the western- and southwestern-most U.S.A. from Oregon to Texas (Trock, 2006). They are adapted to habitats ranging from hot grasslands to the Arctic and including dry to mesic grasslands, savannas, woodlands, wet shores, swamps, marshes, and fens. This treatment represents a contribution toward the evolution of a more natural system of classification of the complex.

The most prominent ecological and morphological difference among the populations is between those of dry prairie habitats and those of more mesic habitats, and this is reflected in the traditional recognition of the two species, *Packera plattensis* and *P. paupercula* s.l., respectively (Barkley, 1962; Trock, 2006). Taxonomic treatments have largely relied on pubescence to segregate *P. plattensis* from *P. paupercula* s.l.: *P. plattensis* by its more-or-less permanent pubescence and *P. paupercula* by its being largely glabrous at maturity (Britton, 1901; Fernald, 1950; Rydberg, 1954, 1965; Cronquist, 1955; Barkley, 1962, 1986; Steyermark, 1963; van Bruggen, 1976; Trock, 2006). This character, like most in the complex, is not absolute. For example, a population from north-central Texas (Parker Co., Willow Spring Cemetery) that is ecologically and morphologically *P. plattensis* is completely glabrous, and a population from the western shore of Lake Huron (Michigan, Presque Isle Co., Thompson's Harbor) that is ecologically and morphologically *P. paupercula* var. *paupercula* is permanently pubescent, like many in this area. However, despite such exceptions, recognition of the two species is warranted, a conclusion

reinforced by their cytological differences, i.e., as far as is known, *P. plattensis* is tetraploid with a base number of $x = 23$ and *P. paupercula* s.l. is mostly diploid with $x = 22$ with tetraploid populations frequent.

Within *Packera paupercula* s.l., populations differ markedly in pubescence across their range and within particular habitats. All have at least sparse tufts of hair in their leaf axils. The type population of *Senecio pauperculus* Michaux is from the shore of Lake St. Jean, Quebec (Brunet, 1864), and, although a search of the area by the junior author (August 1972) indicates that raising and stabilizing of the lake level probably has exterminated the type population, observation of the type material and populations from the vicinity of the St. Lawrence River (e.g., Kowal, 1975) west to Lake Superior shows that the nomenclaturally typical race is largely glabrous and usually occupies mesic to wet habitats, especially wet shores and fens.

Populations of drier habitats are more likely to have surfaces (e.g., leaves, stems, involucres) lightly to densely tomentose-arachnose. Such pubescence is especially prominent on the abaxial surfaces of leaf blades. The three races described and treated as varieties here include most of these populations in eastern North America. As in the entire *Packera plattensis–P. paupercula* complex, individuals can produce discrete clumps via lateral rosettes sprouting from the base of a flowering stem. However, different modes of asexual reproduction that result in clones clearly distinguish the three varieties. Although not expressed in all individuals and rarely evident on herbarium specimens, the differences in genetic potential for this character are constant, as far as is known. *Packera paupercula* var. *appalachiana* resembles variety *paupercula* in producing branching rhizomes; rarely, in addition, some individuals can produce adventitious shoots on roots. Varieties *savannarum* and *pseudotomentosa* produce only adventitious shoots on roots and only underground stolons, respectively. Besides presumably differing physiologically to adapt them to their different habitats, the three differ from each other in certain morphological tendencies, as detailed in their descriptions and in the keys. Unfortunately, these differences, though real, vary tremendously and, especially on less vigorous plants, are commonly not expressed.

As with most widely distributed taxa adapted to a range of habitats covering a significant range of latitudes and longitudes, racial differentiation occurs at various levels. Taxonomically, only the major groupings are recognized. However, *Packera paupercula* var. *paupercula*, as delimited here, still contains more than one ecotypic, geographic, and/or cytological race, and is ecologically and morphologically polymorphic. For example, on the Gaspé Peninsula, there is a race adapted to limestone, one adapted to serpentine (Kowal, 1975: 66–67), and one putatively of hybrid origin, the taxon previously recognized as "*Senecio gaspensis* Greenman" (Kowal, 1975: 69–88).

Here, we mention one additional race that, if unrecognized, obscures the differences among the species and varieties distinguished in this paper. Many populations from the northwestern Great Lakes region and westward are tetraploid (Morton, 1981; Bain, 1985; Kowal, unpublished data). These are characterized by a number of tendencies: permanent pubescence; larger, oblong to oblanceolate rosette leaf blades; relatively large, symmetrical cauline leaves that are deeply pinnatifid to their tips; and large heads. Individuals reproduce asexually both by short offshoots of caudices or rhizomes and by adventitious shoots on roots. This race occupies mesic to moist habitats, which distinguishes it from the prairie species, *Packera plattensis*, with which it is frequently confused.

Other phenomena blur boundaries between taxa. As with most diploid populations of *Packera* species, *P. paupercula* hybridizes with other species, e.g., *P. anonyma* (Alph. Wood) W. A. Weber & A. Löve, *P. aurea*, *P. obovata*, *P. pseudaurea* var. *semicordata*, *P. tomentosa* (Kowal, 1975; Uttal, 1982). More significantly, the *P. plattensis–P. paupercula* complex in the Ozarks and the West contains more variability than is accommodated by this treatment and requires more study. Packer (Moss, 1983: 591) noted that in Alberta the species formed "a complex in which two or three species may eventually be recognized."

Packera plattensis s. str. occurs in prairies or prairie-like habitats. Most flowering stalks arise from praemorse caudices with dense, unbranched, rather fleshy, pale to faintly orange fibrous roots. It does not commonly reproduce asexually, at least not obviously, but some individuals and populations do produce clones by adventitious shoots on deep roots, which are almost never collected. The rosettes and flowering stalks then terminate vertical underground stems with distantly spaced, inconspicuous, scale-like leaves, which often disappear with age; such stems can be misinterpreted as stolons or even as taproots. Aerial stems are commonly densely tomentose-arachnose to floccose, especially proximally. Rosette and basal leaf blades are firm-textured, typically dark blue-green, and commonly purple abaxially, often deeply so. Such anthocyanin production probably helps protect plants from ultraviolet radiation, which is intense in their exposed prairie and bluff habitats; the trait maintains itself in the greenhouse and transplant garden and so

is genetically fixed and not an environmental modification. Rosette and proximal cauline leaf blades are commonly lobed, at least basally; they may be nearly glabrous in old age. Cauline leaves tend to be few, only gradually reduced in size up the stem, and typically pinnatifid to the tip, even immediately below the inflorescence. Inflorescences are usually congested to compactly corymbose with spreading, relatively short, stout peduncles; lateral branches of the inflorescence rarely much surpass the terminal head. Heads are usually larger than most races of *P. paupercula* in both number and size of parts. With the recognition of our three more-or-less pubescent varieties, *P. plattensis* is now restricted to west of the Mississippi River with a few exceptions, such as Wisconsin and westernmost Illinois (Mahoney et al., 2002: fig. 1). Its range abuts and sometimes overlaps those of variety *savannarum*, variety *pseudotomentosa*, and the Great Lakes tetraploid populations of *P. paupercula* in Wisconsin, Minnesota, Iowa, Illinois, and/or Missouri.

In contrast to *Packera plattensis*, our three new varieties of *P. paupercula* tend to be less pubescent. Rosette and proximal cauline leaf blades tend to be medium to light green, rarely, if at all, anthocyanic, and unlobed, only rarely with a few basal lobes. Cauline leaves are usually more abruptly reduced upward and commonly subentire to bract-like immediately below the inflorescence. Inflorescences are usually open, loosely corymbose with erect to ascending, relatively long, slender peduncles; lateral branches of the inflorescence commonly surpass the terminal head.

Our key treats *Packera plattensis* and the varieties of *P. paupercula* that are currently recognized east of the Rocky Mountains. The complex needs further study, especially in the Ozarks, the western Great Lakes, and western North America. Extensive overlap in shapes, sizes, and numbers of parts necessitates the frequent use of general tendencies. The taxa are effectively polythetic, with an individual having most, but not necessarily all, the characters of a taxon.

KEY TO *PACKERA PLATTENSIS* AND THE *P. PAUPERCULA* VARIETIES OF EASTERN NORTH AMERICA

1a. Asexual reproduction rare or common, by adventitious shoots on roots (never by horizontal underground stolons and almost never by rhizomes).
  2a. Asexual reproduction usually rare, vegetative rosettes produced sparingly from deep roots; roots at base of flowering stem commonly densely clustered, pale, and fleshy; blades of rosette and proximal cauline leaves commonly longer than petioles, usually widest below the middle and commonly lobed, firm-textured and deep spinach green, commonly purple abaxially; heads in ± congested inflorescences; dry prairies and drier prairie-like habitats (e.g., bluffs); Great Plains, from the eastern flank of the southern Rocky Mountains to the Mississippi River, with scattered sites in Wisconsin, Illinois, Missouri, Arkansas, and Texas (tetraploids, $x = 23$) . . . . . *P. plattensis*
  2b. Asexual reproduction typically common and forming evident clones, vegetative rosettes arising from shallow or deep roots; roots at base flowering stem relatively few and fibrous; blades of rosette leaves and proximal cauline leaves commonly shorter than petioles, widest at or above the middle and only rarely lobed, soft-textured and medium to light green, rarely, if ever, purple abaxially; heads in ± open inflorescences; mesic prairies, savannas, open woodlands, and grassy areas; eastern Iowa, southeastern Minnesota, southern Wisconsin and Michigan, and northern Illinois and Indiana (diploids, $x = 22$) . . . . . *P. paupercula* var. *savannarum*
1b. Asexual reproduction usually common, by either rhizomes or horizontal underground stolons (occasionally, in addition, with adventitious shoots on roots).
  3a. Asexual reproduction by thin (≤ 1.8 mm), whitish, horizontal underground stolons with long internodes (commonly > 10 mm); dry to mesic, prairies, barrens, savannas, bluffs, and dunes; Midwest: Arkansas, Missouri, Iowa, Wisconsin, Illinois, Indiana, Ohio, lower peninsula of Michigan, and southernmost Ontario (diploids and tetraploids, $x = 22$) . . . . . *P. paupercula* var. *pseudotomentosa*
  3b. Asexual reproduction by stout (mostly > 2 mm), greenish to anthocyanic rhizomes, with short (mostly < 5 mm) internodes, or asexual reproduction absent; various habitats in much of eastern North America.
    4a. Blades of rosette leaves ovate, broadly elliptic, to elliptic-oblong to obovate to nearly round, usually persistently tomentose abaxially (sometimes glabrate), bases truncate to acute, rarely subcordate, apices usually rounded; dry, rocky to gravelly soils; wooded bluffs, road cuts; southern Appalachian Mountains: West Virginia, Virginia, North Carolina, Tennessee (diploids and tetraploids, $x = 22$). . . . . *P. paupercula* var. *appalachiana*
    4b. Blades of rosette leaves narrowly lanceolate, elliptic or oblanceolate, glabrous to glabrate abaxially (sometimes persistently tomentose), bases attenuate to acute (sometimes obtuse to truncate), apices acute to rounded; dry to wet soils; mesic to wet habitats, especially shores and fens; northeastern North America, from Labrador and Newfoundland south to North Carolina, extending westward through the Great Lakes region and beyond, disjunct in the Black Hills (diploids and tetraploids, $x = 22$) . . . . . *P. paupercula* var. *paupercula*

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A New Polyploid Species of the Genus *Tragopogon* (Asteraceae, Cichorieae) from Russia

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ABSTRACT. *Tragopogon soltisiorum* Mavrodiev (Asteraceae, Cichorieae, Scorzonerinae) is described as a new species. The new species is a tetraploid ($2n = 24$), ruderal plant with long flowering and fruiting times and differs from the vast majority of *Tragopogon* L. species in its ability to reproduce vegetatively from adventitious shoots. The new species is known only from southern Russia and is found in two varieties—a typical variety and a new variety *latifolius* Mavrodiev.

Key words: Asteraceae, IUCN Red List, polyploidy, Russia, *Tragopogon*.

Tragopogon L. (Asteraceae, Cichorieae, Scorzonerinae) is an Old World genus of 110 to 150 species (Borisova, 1964; Bremer, 1994) that occurs across Eurasia. The chromosome number reported for most species of *Tragopogon* is $2n = 12$ (e.g., Nazarova, 1991). At least 12 species of *Tragopogon* are tetraploids or include tetraploid cytotypes (Singh & Kachroo, 1976; Wilson, 1983; Nazarova, 1991, 1995; Ghaffari, 1999; Díaz de la Guardia & Blanca, 2004). The most well-known polyploids are two allotetraploid species, *T. mirus* Ownbey and *T. miscellus* Ownbey, which formed in North America in the early 1900s following the introduction of three diploids from Europe (Ownbey, 1950).

Most of the known *Tragopogon* tetraploids occur in western Asia and only three, that are narrow endemics, are considered part of the European flora sensu *Flora Europaea* (Richardson, 1976): *T. cupani* Gussone ex DC. (Sicily, Italy), *T. castellanus* Levier (northern half of the Iberian Peninsula), and *T. cazorlanum* C. Díaz & Blanca (mountains of Cazorla and Segura, Spain) (Zangheri, 1976; Díaz de la Guardia & Blanca, 2004). The Spanish endemic *T. pseudocastellanus* Blanca & C. Díaz also appears to be polyploid based on the size of the pollen (Blanca & Díaz de la Guardia, 1996), but no chromosome count of *T. pseudocastellanus* is available. In the southern portion of European Russia, several populations of an unknown polyploid *Tragopogon* have recently been discovered.

Material used for the current study was successfully grown in the greenhouse of the Botany Department of the University of Florida (Gainesville) from seeds collected in May 2001 in the southeastern part of European Russia near the city of Astrachan (FLAS 215760, FLAS 215761). Mitotic chromosomes were studied using root meristems obtained from the above cultivated plants. The root tips were pretreated with 8-hydroxyquinoline, fixed in ethyl alcohol–acetic acid (3:1), hydrolyzed in 1N HCl, stained in an acetic orcein solution, and then squashed and the chromosomes counted using light microscopy.

1. Tragopogon soltisiorum Mavrodiev, sp. nov. TYPE: Russia. Astrachan Oblast: vic. of city of Astrachan, 15 May 2001 [type from seed cultivar, Univ. of Florida, Gainesville, Botany Greenhouse, 4 Aug. 2005], *Evgeny V. Mavrodiev 1* (holotype, FLAS 215760; isotype, FLAS 215759). Figures 1, 2.

Herba perennis, gemmis radicalibus dormientibus vix conspicuis sed numerosissimis; axe primario deflorato ablatove, haec gemmae soboles numerosas plerumque formantes. Bracteae involucrales quam flores ligulati semper breviores; flores marginales semper pallide lutei, striis 3 to 5 plus minusve conspicuis violaceis in pagina superiore ornati; rostrum achaenii breve.

Perennial herb 0.3–1.7 m, glabrous or scaberulous generally at leaf bases and below capitula; primary root extensively branched, shoots adventitious from root buds from entire root system after flowering or after cutting the main axis of plant (Fig. 2A). Rosette

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Figure 1. Holotype of *Tragopogon soltisiorum* Mavrodiev (*E. V. Mavrodiev 1*, FLAS 215760).

leaves numerous, to 45, rosette leaf laminae wider than stem leaves, 8–50 × (0.6–)0.7–1.2(–2.0) cm, with 5 to 9 evident parallel nerves, margins entire or crenate, lanceolate or narrowly lanceolate; middle nerve extends beyond lamina as mucro; stem leaves without sheaths, 3–35 × (0.2–)0.3–1.0 cm, narrowly lanceolate, acute, with 5 to 7 well-formed nerves. Fertile stems solitary, simple or once (twice) branched from the middle, terminating into a capitulum, not swollen below the capitulum. Capitula to 35 mm, solitary; involucral bracts (= phyllaries) 8 to 10, triangular or lanceolate,

Figure 2. *Tragopogon soltisiorum* Mavrodiev. —A. Adventitious shoots. —B. Violet stripes on the adaxial side of *T. soltisiorum* ligules. —C. Capitula of variety *latifolius*. —D. Karyotype of variety *soltisiorum* ($2n = 24$). —E. Karyotype of variety *latifolius* ($2n = 24$).

glabrous or scabrous, 25–30(–35) mm, always shorter than marginal florets. Florets with pale yellow ligules, 25–30(–33) mm, bearing 3 to 5 ± obvious violet stripes adaxially (Fig. 2B); anthers 3–3.3(–3.5) mm. Achenes with gray or partly rose plumose pappus, (17–)20–22 mm, ± equal to achene body, with short but well-developed beak, to 7(–8) mm, distinct from numerous protuberances,

to 0.02 mm, covering the remainder of non-ribbed achene body; germination epigeous.

1a. Tragopogon soltisiorum var. **soltisiorum**

1b. Tragopogon soltisiorum var. **latifolius** Mavrodiev, var. nov. TYPE: Russia. Astrachan Oblast: vic. of city of Astrachan, 15 May 2001 [type from seed cultivar, Univ. of Florida, Gainesville, Botany Greenhouse, 4 Aug. 2005], *Evgeny V. Mavrodiev 2* (holotype, FLAS 215762; isotype, FLAS 215761).

A varietate typica foliis latioribus (usque ad 20 mm latis) et additione inflorescentia 2- ad 3-calathidiata differt.

The variety *latifolius* differs from the typical one by its wider leaf laminae (to 20 mm) and by its additional capitula to 2 or 3 in number (Fig. 2C).

Chromosome number. The chromosome number $2n = 24$ was found in the plants of both varieties (Fig. 2D, E).

Distribution and IUCN Red List category. Tragopogon soltisiorum is known only from the Astrachan region (southeastern Russia). It was widely distributed in the vicinity of the city of Astrachan in 2001–2002. The new taxon and its new variety are considered mostly ruderal plants.

We estimate the current area of distribution of both varieties of the new tetraploid as 5000–20,000 km^2, and the number of localities as more than 10. All populations are fluctuating in size. Based on these facts, the species could be considered as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001).

Phenology. In natural habitats, the new species flowers and fruits in April and May until the second half of October (A. Laktionov, pers. comm.). This is a longer anthesal time compared to other species of *Tragopogon* (including all sympatric species from the Astrachan region), which bloom and fruit from (April) May to August (September).

Etymology. The new polyploid species is named in honor of professors Douglas E. Soltis and Pamela S. Soltis.

Discussion. Tragopogon soltisiorum is a highly variable taxon. The new species differs from most of *Tragopogon* (including all known polyploids) by the formation of adventitious shoots. In gross morphology, *T. soltisiorum* appears similar to *T. graminifolius* DC. or *T. orientalis* L., but it differs from both in possessing violet stripes on the dorsal side of its ligules and by the adventitious shoots. Underground organs and the details of life history clearly require further investigation.

Key to *Tragopogon soltisiorum* and Similar Species

1a. Biennial; involucral bracts shorter than or ± equal to ligules; the latter are golden yellow, without stripes . . . . . *T. orientalis*
1b. Perennial; involucral bracts longer than or ± equal to ligules; the latter are yellow or pale yellow, with or without stripes 2
2a. Ligules are yellow, without stripes; root buds and adventitious shoots are absent . . . . . *T. graminifolius*
2b. Ligules are pale yellow, with ± obvious violet stripes on adaxial side; root buds and adventitious shoots are present . . . . . *T. soltisiorum*

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Setaria carinata (Poaceae, Paniceae): Especie Nueva de Venezuela

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RESUMEN. Se describe e ilustra una especie nueva para la ciencia, *Setaria carinata* S. Nozawa & Pensiero, proveniente de Venezuela. *Setaria carinata* difiere de las especies afines principalmente por poseer 9 a 10 setas por espiguilla, la ornamentación y lo fuertemente carinado de la lemma superior, y pálea inferior angosta. Se presenta una clave para discriminar entre especies afines.

ABSTRACT. A new species from Venezuela, *Setaria carinata* S. Nozawa & Pensiero, is described and illustrated. *Setaria carinata* differs from closely related species by the number of bristles (nine to 10 per spikelet), the ornamentation of the strongly carinate upper lemma, and its narrow lower palea. An identification key to discriminate between similar species is presented.

Key words: Anzoátegui, IUCN Red List, Monagas, Poaceae, *Setaria*, Venezuela.

Durante la elaboración de la sinopsis del género *Setaria* P. Beauvois para Venezuela (Nozawa, en prep.), que se está realizando en la Fundación Instituto Botánico de Venezuela, se encontraron unas muestras diferentes a las ya conocidas para el género, por lo que a continuación se propone y se describe una especie nueva.

Setaria carinata S. Nozawa & Pensiero, sp. nov. TIPO: Venezuela. Anzoátegui: alrededores de Pariaguán, *A. Hernández 65* (holotipo, VEN; isotipo, MO). Figura 1.

Species nova *Setariae parviflorae* (Poiret) Kerguélen affinis habitu et inflorescentia, sed diversa: lemma superiore intense carinato, ad basem abrupte plano, fere laevi, et palea inferiore angusta, marginibus paleam superiorem non attingentibus. Item, spicula speciei novae *S. hassleri* Hackel similis ornamento et carina lemmatis superioris, sed differt: axe inflorescentiae scabro, pilis destituto, spicula singula 9 ad 10 setis denticulis antrorsis praeditis subtenta, gluma superiore 5(ad 7)-nervi, 1/2–2/3 anthoecia superius aequante.

Planta anual, macollante, a veces grácil, con innovaciones intravaginales, cañas de 11–28 cm alto y 1–2 mm diám. en su base, geniculadas, ramificadas sobre todo en la base, a veces enraizadas en los nudos inferiores, con 3 a 6 nudos glabros. Vainas glabras, con el dorso ligeramente aquillado, los márgenes glabros; lígulas ciliadas, de 0.6–0.8 mm; láminas lineares o linear-lanceoladas, planas o con los márgenes ligeramente convolutados, de 2.5–12 × 0.3–0.7 cm, haz ligeramente escabroso en la base, con pelos ralos, largos, hasta de 4.5 mm de longitud, densos sólo cerca de la lígula, envés glabro, ápice agudo. Inflorescencia en panícula espiciforme, densa, compacta, de 1–5 × 0.7–1.1 cm incluyendo las setas; raquis anguloso, fuertemente escabroso, ramas muy breves, normalmente no mayores de 0.5 cm. Espiguillas ovoides o ligeramente obpiriformes, de ca. 2 × 1.2–1.3 mm, acompañadas por 9 a 10 setas involucrales antrorso-escabrosas agrupadas en dos fascículos de 4 a 5 setas cada uno, de (2–)4–5 mm de longitud y grosor relativamente uniforme, adelgazándose ligera y gradualmente hacia el ápice que es truncado, pardo claras o pajizas; gluma inferior 1/3–1/2 del largo de la espiguilla, 3-nervia, los nervios marginales se unen al nervio central antes de llegar al ápice; gluma superior alcanzando 1/2–2/3 del largo del antecio superior, con 5(a 7) nervios verdes, ápice ligeramente apiculado; antecio inferior asexuado, con lemma amplia, abrazando con sus márgenes a la lemma superior e igualando su largo, con 7 nervios verdes, ápice ligeramente apiculado, pálea inferior membranosa, del mismo largo que el antecio superior y ligeramente más angosta, sin que sus márgenes toquen los de la pálea superior, con 2 nervios verdes marginales; antecio superior ovoide, de ca. 2 × 1.2–1.3 mm, pajizo a la madurez, lemma corrugada,

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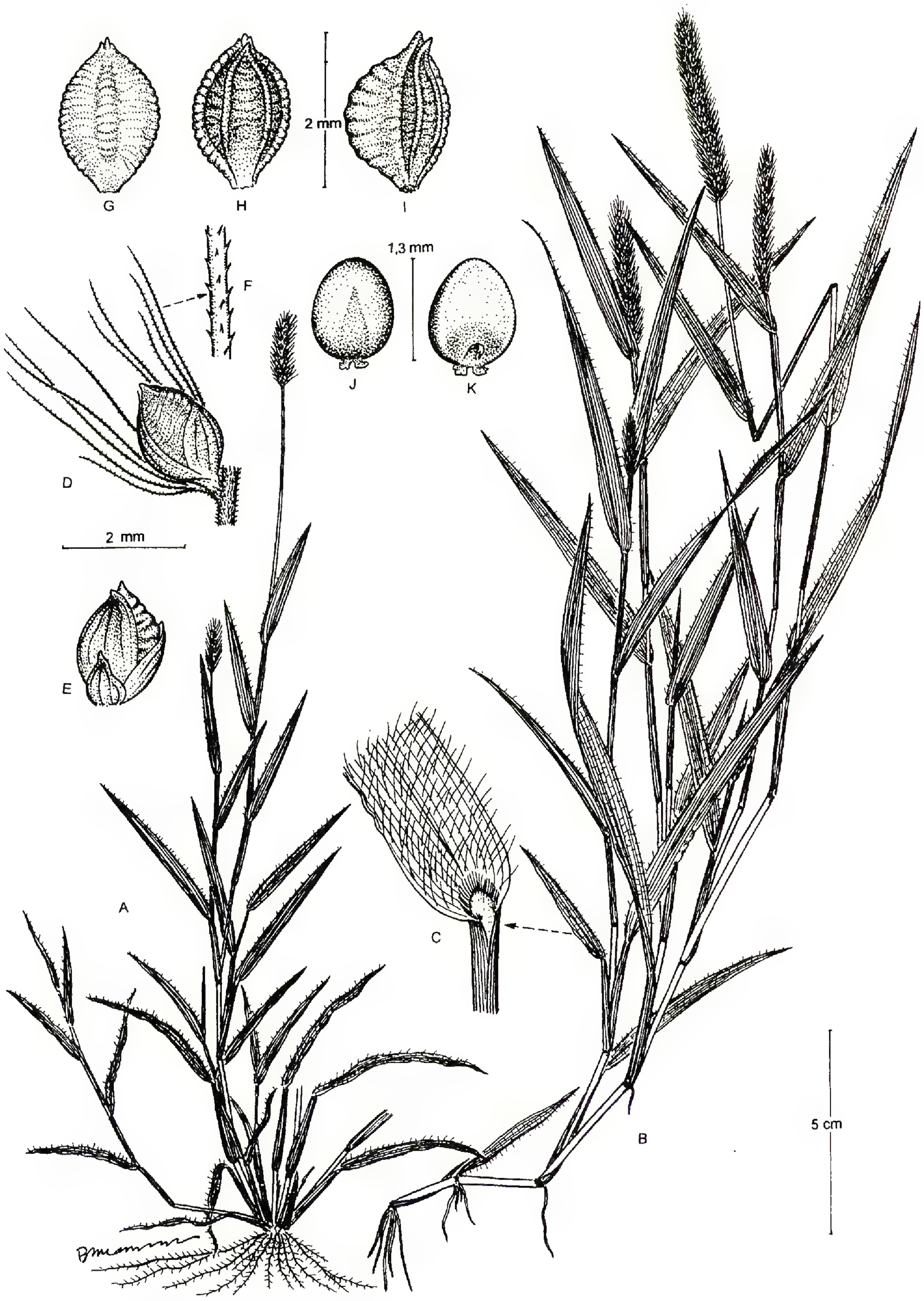

Figura 1. *Setaria carinata* S. Nozawa & Pensiero. —A, B. Diferentes tipos de hábito. —C. Detalle base de lámina y lígula (5×). —D. Segmento de inflorescencia mostrando espiguilla con setas acompañantes. —E. Espiguilla vista desde gluma inferior. —F. Detalle dentículos. —G. Antecio superior vista dorsal. —H. Antecio superior vista ventral mostrando la pálea inferior. —I. Antecio superior vista lateral. —J. Cariopsis vista dorsal. —K. Cariopsis vista ventral. (B, dibujado de *A. Lárez 533* [VEN]; resto del tipo *A. Hernández 65* [VEN]).

fuertemente rugosa, con surcos conspicuos, marcadamente carinada, cuyos márgenes no alcanzan a abrazar los nervios marginales de su pálea dejándolos visibles, base abruptamente plana, casi lisa, ápice apiculado, a veces con un apículo central marcado y dos laterales ligeramente insinuados, pálea rugosa y endurecida ventralmente, el resto membranoso e hialino cubriendo parcialmente la flor, con un par

de nervios marginales anastomosados delimitando la parte rugosa de la parte membranosa, ca. 1 mm ancho. Cariopsis anchamente ovoide, plano-convexa, convexa en el dorso y ventralmente subplana pero cóncava en la base, de ca. 1.3 × 1 mm, escudete largamente triangular alcanzando 4/5 de su largo, hilo punctiforme.

Distribución. Hasta ahora se la conoce únicamente de colecciones venezolanas, de los estados Anzoátegui, Monagas y Sucre. Habita principalmente en los llanos venezolanos, en sabanas, morichales, orillas de carretera y vegetación secundaria.

Estado de conservación. La mayoría de las muestras han sido colectadas en lugares que no se encuentran bajo figuras de protección legal, a excepción de una muestra colectada en Parque Nacional en el estado Sucre, asegurando al menos una población protegida, esto junto con su capacidad de crecer en lugares con influencia antrópica le confiere cierta resistencia a la intervención humana. Sin embargo, debido a su distribución en los llanos, que es un continuo colombo-venezolano, se necesita verificar su posible presencia en Colombia para delimitar su distribución geográfica, y además como no se cuenta con suficiente información sobre su tamaño poblacional para poder llegar a un veredicto definitivo, por el momento se la clasifica bajo la categoría Datos Insuficientes (DD) (UICN, 2001).

Etimología. El epíteto específico hace alusión a la lemma superior fuertemente carinada que presenta la especie.

Nombre vernáculo. "Pata de tara" (*A. Hernández 65*, VEN).

Discusión. Por su hábito e inflorescencia similar, esta especie ha sido confundida con *Setaria parviflora*, pero los caracteres de la espiguilla la separa claramente. Por otro lado, la espiguilla de *S. carinata* es parecida a la de *S. hassleri*, sobre todo en la ornamentación y lo carinado de la lemma superior, sin embargo, *S. hassleri* posee eje de la inflorescencia con pelos largos, cada espiguilla se encuentra acompañada por 1 a 3 setas con dentículos retrorsos en el ápice y gluma superior 7- a 9(a 12)-nervia, 4/5 o de igual largo que la lemma superior.

De acuerdo al esquema taxonómico de Pensiero (1999) y Rominger (1962), *Setaria carinata* pertenece al subgénero *Setaria*, ya que las láminas carecen de pliegues longitudinales y todas las espiguillas se encuentran acompañadas por una o más setas involucrales. La siguiente clave permite discriminar esta nueva especie de aquellas afines del subgénero.

Paratipos. VENEZUELA. **Anzoátegui:** Mpio. Freites, Morichal Morichalote, 6–7 km O del río Oritupano, 110–120 m, *A. Fernández, J. Fernández & C. Reyes 12787* (PORT, US); Sabanas del río Cani, entre Guanipa y Cantaura, *Z. Luces 80* (VEN); Pariaguán, *A. Müller 825* (MO, VEN), *L. Cumana & R. Delgado 4891* (IRBR). **Monagas:** Mpio. Piar, Carretera Vía Manresa, *A. Lárez 533* (UOJ, VEN); Mpio. Maturín, entre los ríos Guanipa–El Tigre y El Tigre–Morichal Largo, *H. Rodríguez 1849* (MY); Mpio. Ezequiel Zamora, orilla carretera Punta de Mata–Crucero Potrerito–Maturín (Km 607–608), *S. Rodríguez 11 y 13* (PORT). **Sucre:** Guaranache, Santa Marta, P.N. Mochima, *L. Cumana & L. Mazo 6034* (IRBR).

Clave para las Especies de *Setaria* subgénero *Setaria* con Más de Tres Setas Acompañando Cada Espiguilla, Tanto del Nuevo Como del Viejo Mundo

1a. Espiguillas de 2.8–3.8 mm long.
  2a. Plantas perennes, rizomatosas; setas ligeramente clavadas en el ápice . . . . *S. nigrirostris* (Nees) T. Durand & Schinz
  2b. Plantas anuales; setas con grosor relativamente uniforme . . . . . *S. glauca* (L.) P. Beauvois
1b. Espiguillas menores de 2.8 mm.
  3a. Panojas mayores de 12 cm; vainas basales de aspecto iridáceo . . . . . *S. sphacelata* var. *sericea* (R. E. Massey ex Stapf) Clayton
  3b. Panojas de 2–8 cm; vainas basales sin aspecto iridáceo.
    4a. Lemma superior fuertemente carinada y base abruptamente plana, casi lisa; pálea inferior angosta, sin que sus márgenes toquen los de la pálea superior. . . . . *S. carinata* S. Nozawa & Pensiero
    4b. Lemma superior no carinada, y base convexa, rugosa; pálea inferior del mismo ancho que la pálea superior.
      5a. Plantas anuales; antecio superior con lemma fuertemente corrugada, con notables y gruesos pliegues transversales. Viejo Mundo. . . . . *S. ustilata* de Wit
      5b. Plantas perennes; antecio superior con lemma rugosa, sin conspicuos pliegues transversales.
        6a. Gluma superior algo mayor de 4/5 o de igual largo que el antecio superior; gluma inferior alcanzando 3/4 del largo de la espiguilla . . . . . *S. parviflora* var. *brachytricha* Pensiero
        6b. Gluma superior alcanzando 1/2–3/4 del largo del antecio superior; gluma inferior 1/3–1/2 del largo de la espiguilla.
          7a. Láminas glabras, a veces con pelos largos en la cara adaxial próxima a la lígula . . . . . *S. parviflora* var. *parviflora* (Poiret) Kerguélen
          7b. Láminas hirsutas en ambas caras . . . . . *S. parviflora* var. *pilosissima* (Hackel) Pensiero

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A New Species of *Lycianthes* (Solanaceae) from the Pacific Region of Colombia

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ABSTRACT. A new species of *Lycianthes* (Dunal) Hassler (Solanaceae, Capsiceae) is described and illustrated. *Lycianthes bullata* C. I. Orozco, C. A. Vargas & Serralde is found at low altitudes in the Pacific region of Colombia. This species belongs to the subgenus *Polymeris* (Dunal) Bitter; it is a vine and exhibits stellate and stalked ferruginous hairs and unifoliate sympodia. It is related to *L. ferruginea* Bitter but can be distinguished from this species by the intense ferruginous color of its indument; its larger foliar lamina (6.5–19 × 5–9 cm), elliptic to ovate, with adaxial surface glossy and bullate, and abaxial surface extremely reticulate; its larger flowers (15–17 mm long); the presence of five or six stamens; and its larger fruits (16–30 mm in diam.).

RESUMEN. Una especie nueva de *Lycianthes* (Dunal) Hassler (Solanaceae, Capsiceae) se describe e ilustra. *Lycianthes bullata* C. I. Orozco, C. A. Vargas & Serralde se encontró en la región del Pacífico a bajas altitudes. Esta nueva especie pertenece al subgénero *Polymeris* (Dunal) Bitter, es una liana leñosa, con pelos ferrugineos estrellados, estipitados, unidades simpodiales unifoliadas. Es semejante a *L. ferruginea* Bitter pero se diferencia de ésta por el fuerte color ferrugíneo del indumento, sus grandes láminas foliares (6.5–19 × 5–9 cm), extremadamente brillantes, bulladas y fuertemente reticuladas por el envés, elípticas a ovadas, sus grandes flores con corolas de (15–17 mm de longitud), la presencia de 5 o 6 estambres, y sus frutos grandes (16–30 mm in diámetro).

Key words: Capsiceae, Colombia, IUCN Red List, *Lycianthes*, Pacific region, Solanaceae, Solanoideae.

The genus *Lycianthes* (Dunal) Hassler (Solanaceae) is recognized by a truncate 10-nerved calyx, the nerves often prolonged into lateral teeth, sometimes subterminal or exceeding the calyx. The genus has been included in *Solanum* L. due to shared characteristics such as poricidal dehiscence of the anthers and interpetalar tissue. Bitter (1919) segregated *Lycianthes* from *Solanum*; however, in many cases the differences between *Lycianthes* and *Solanum* are so subtle that magnification must be used to observe the five or 10 teeth arising below the cup-shaped calyx. Studies based on morphological (D'Arcy, 1986) and molecular information (Olmstead et al., 1999) indicate a closer relationship between *Lycianthes* and *Capsicum* L. Investigation of the phylogeny based on the chloroplast genes *ndhF* and *trnL-F* indicates that *Lycianthes* is not monophyletic, and some species sequenced for the analysis are more closely related to *Capsicum* (Olmstead, pers. comm., 2006). Records in the literature point to the use of some species of *Lycianthes* as food sources (Benitez de Rojas & D'Arcy, 1997; Dean, 2004).

The majority of the 200 species of *Lycianthes* are distributed in the New World, from Mexico to Argentina, with the greatest concentration of species found in northern South America (Barboza & Hunziker, 1992). However, Dean (2004) considers approximately 30 species occurring in the Old World, Asia, and Australia.

There has been no comprehensive taxonomic work on the genus since Bitter (1920); however, some taxonomic studies have been carried out at a regional or restricted level. These studies include the following for *Lycianthes*: D'Arcy (1973) in Panama; Barboza and Hunziker (1992) in Argentina; Benitez de Rojas and D'Arcy (1997) in Venezuela; and the series *Meizonodontae* Bitter by Dean (2004) for Mexico and Central America. Species lists also exist for *Lycianthes* in catalogues by Jørgensen and León-Yánez (1999) for Ecuador, and Brako and Zarucchi (1993) for Peru. Taxonomic study is currently being prepared for *Lycianthes* in Colombia by Orozco et al. (unpublished data). As a result of this ongoing study, a new species of *Lycianthes*, collected in the Pacific region of Colombia, is proposed here.

Lycianthes bullata C. I. Orozco, C. A. Vargas & Serralde, sp. nov. TYPE: Colombia. Valle: N shore of Buenaventura Bay, Estero de Cangrejo, near sea level, 3 June 1944, *E. P. Killip & J. Cuatrecasas 38729* (holotype, COL; isotype, US). Figure 1.

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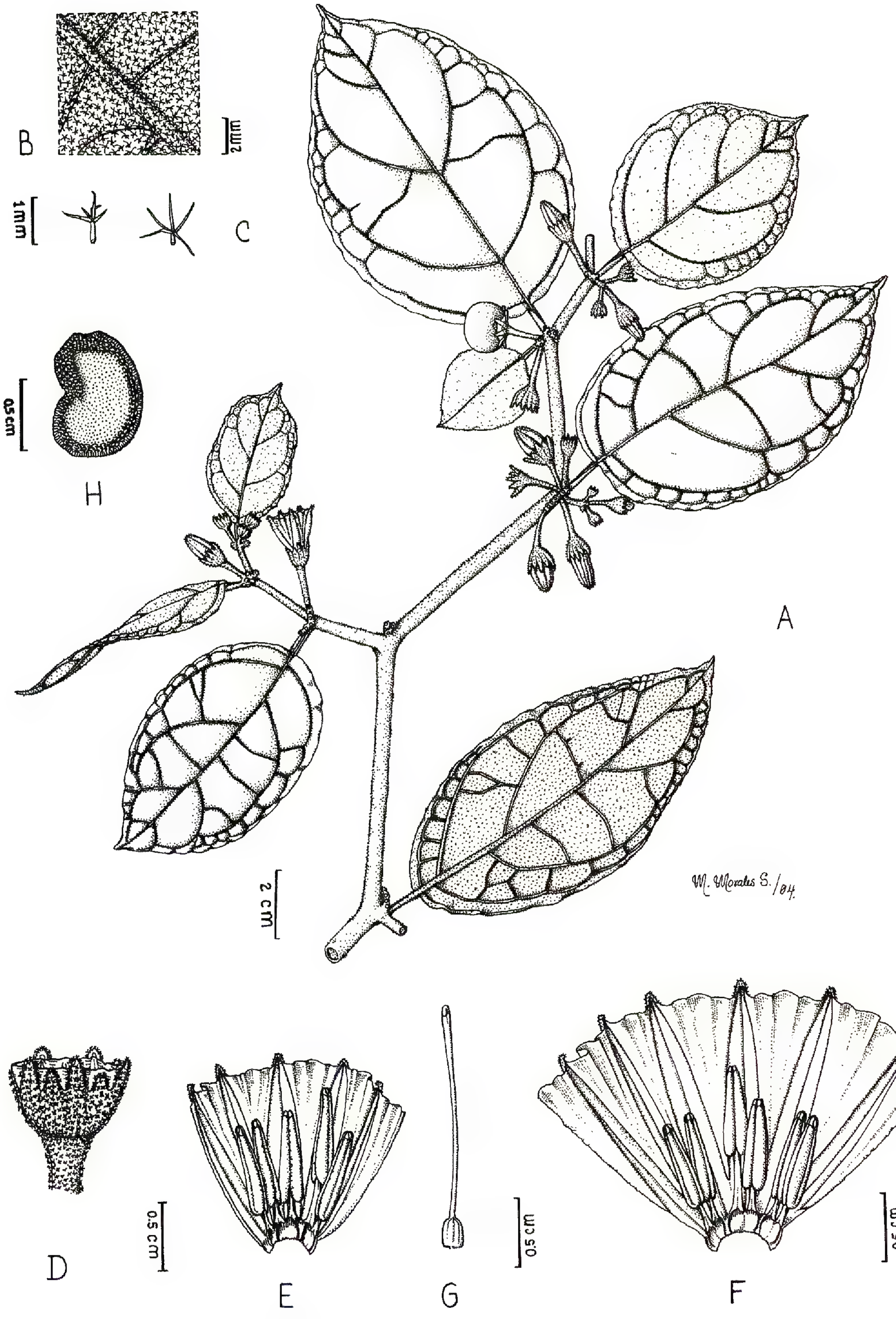

Figure 1. *Lycianthes bullata* C. I. Orozco, C. A. Vargas & Serralde. —A. Floriferous branch. —B. Abaxial foliar surface. —C. Types of hairs. —D. Calyx. —E. Flower with five stamens. —F. Flower with six stamens. —G. Gynoecium. —H. Seed. A–H based on the type *E. P. Killip & J. Cuatrecasas 38729* (COL).

Lycianthi ferrugineae Bitter affinis, sed foliis ellipticis ovatis, longioribus (6.5–19 cm non 3.5–12 cm) latioribusque (5–9 cm non 3.5–6.5 cm), lamina supra manifeste reticulata et venis impressis, subtus venis prominentibus, et indumento denso manifeste ferrugineo, corolli longioribus (15–17 mm non 8–10 mm), fructibus majoribus (16–30 mm non 10–20 mm diam.), seminibus longioribus (4–9 mm non 3.5–5 mm) differt.

Vine with cylindrical stems and branches, longitudinally striate; buds and young branches densely pubescent, indument ferruginous with stellate and stalked hairs or less frequently dendritic ones; sympodia unifoliate, apparently difoliate in young branches. Leaves petiolate; lamina 6.5–19 × 5–9 cm, chartaceous, elliptic to ovate, even orbicular, margins entire, base obtuse to cuneate, apex acuminate, adaxial surface bullate, olive green or brown, abaxial surface densely pubescent, with stellate, stalked hairs and prolonged midpoint, sometimes reduced, ferruginous; fresh leaves yellowish green, glossy in both dry and fresh material, soon glabrescent, with persistent indument on veins; secondary veins 4 to 6, ascending, diverging at 45°–60°, secondary and tertiary veins impressed adaxially and strongly raised abaxially; petiole 10–20 mm, terete, caniculate ventrally, indument similar to the young branches. Inflorescences in axillary terminal cymes, densely ferruginous, with 5 to 8 flowers; floral buds 4.5–9 mm diam. Flowers pedicellate, with pedicels 10–20 mm; calyx truncate, dentate, 5–8 × 6–9 mm, cup-shaped, calyx margins upright, teeth on the infra-margin of the calyx in 2 series, scarcely exceeding the margin of the calyx, the longest 1–2 mm, the smallest < 1 mm, apex obtuse, densely pubescent; corolla 15–17 mm, white tinged with pink, with sparsely stellate and stalked hairs, corolla tube slightly constricted at the base, ca. 4 mm; petals 5, 11–12 mm, the lobe apex obtuse, ca. 1 × 2 mm, the corolla united by interpetalar tissue, ca. 10 × 2–4 mm; pedicel 5–20 mm, stamens 5 or 6, unequal, with laminar filaments, one longer than 5 mm, the others shorter than 2 mm, basally adnate to petals for 1–2 mm; anthers 6 mm, long-ovate, stellate and stalked hairs where thecae meet; style 11 mm, stigma bilobed, clavate; ovary ovate, ca. 1 × 1 mm. Fruits as orange berries, rounded, 16–30 mm diam., calyx persistent on fruit, 6–7 × 15–23 mm, prominent ribs on calyx, teeth 3–4 mm. Seeds yellow, clear, reniform, 4–9 × 4–6 mm, 35 to 45 per fruit.

Distribution and IUCN Red List category. *Lycianthes bullata* is found in the Western Cordillera of the Colombian Andes in Valle Department, in southwestern Colombia, at low altitudes from sea level to 230 m. It is usually found in disturbed areas, in nutrient-poor soils and active successional areas, as well as coastal lagoons. *Lycianthes bullata* is known from only a few collections and should be considered Endangered (EN) according to IUCN Red List criteria (IUCN, 2001). This assessment is based on the scarce collections found in COL, the absence of collections in the remaining national herbaria, the species' disturbed habitat, and the lack of any report of collection since 1984 (*M. Mosalve 513*). It should also be noted that few collections were found in our review of specimens at US.

Phenology. Collected with flowers in February and June, with fruits in June and November.

Etymology. The specific epithet is from the Latin "bullatus," referring to the blistered appearance of the epidermis.

Discussion. The new species exhibits a set of characters not present in other species of *Lycianthes*. It is distinguished by unifoliate sympodia and large and wide glossy leaves (6.5–19 × 5–9 cm) that are bullate adaxially, deeply reticulate abaxially, densely ferruginous, and with a conspicuous indument of branches and stalked hairs on the abaxial surface. Further, *L. bullata* is distinguished by its larger corollas (15–17 mm long) that are white tinged with pink, its upright calyx margin, its five or six stamens, and its larger fruits (16–30 mm in diam.) and seeds (4–9 × 4–6 mm).

This species could be confused with *Lycianthes ferruginea*, which is distributed at higher elevations in Colombia (cf., *Th. Croat 51913*, *J. Fernández Alonso 14276*, *J. Steyermark & E. Dunsterville 98795*). However, *L. ferruginea* is distinguished by the smaller size and smooth surface of the foliar lamina (3.5–12 × 3.5–6.5 cm); the ochre-colored, pubescent indument; the smaller, white flowers (8–15 cm long); the concave calyx margin; and the presence of only five stamens.

Paratypes. COLOMBIA. **Valle:** Costa del Pacífico, río Yurumanguí, 28 Jan.–10 Feb. 1944, *J. Cuatrecasas 15751* (US); Buenaventura, bajo Calima, Concesión Pulpapel, 20 Nov. 1984, *M. Monsalve 513* (COL, MO not seen, US); Buenaventura, comm. San Isidro, 15 Nov.–6 Dec. 1979, *J. Van Rooden 306*, *309* (COL).

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A New Species of *Parathesis* (Myrsinaceae) from Colombia

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Abstract. A new species of *Parathesis* (A. DC.) Hooker f., *P. calimensis* Ricketson & Pipoly (Myrsinaceae), from the Department of Valle del Cauca, Colombia, is described and illustrated. *Parathesis calimensis* has terminal or terminal and lateral inflorescences, dorsifixed anthers, and a fine, closely appressed tomentum on the branchlets and abaxial leaf surfaces, which places it in *Parathesis* subg. *Parathesis* sect. *Cubanae* Ricketson & Pipoly. It is most similar to *P. pseudocrassiramea* Ricketson & Pipoly from Costa Rica but is easily recognized by its terete branchlets, large leaves, and fruits.

Resumen. Se describe y se ilustre una nueva especie del género *Parathesis* (A. DC.) Hooker f., *P. calimensis* Ricketson & Pipoly, proveniente del Departamento del Valle del Cauca, Colombia. Con inflorescencias terminales y laterales, anteras dorsifijas y con vestidura de las ramitas y el envés folia tomentosa fina y adpresa pertenece al subgénero *Parathesis* sect. *Cubanae* Ricketson & Pipoly. Es muy parecida a *P. pseudocrassiramea* Ricketson & Pipoly de Costa Rica, pero se reconoce fácilmente por sus ramitas teretes y el tamaño mayor de las hojas y frutos.

Key words: Colombia, IUCN Red List, Myrsinaceae, *Parathesis*, *Parathesis* subg. *Parathesis* sect. *Cubanae*, Valle del Cauca.

The genus *Parathesis* (A. DC.) Hooker f. contains 96 species distributed from northern Mexico to Panama, the Caribbean, and throughout the Andes from Venezuela to Bolivia. The genus is defined (Ricketson & Pipoly, 1997, 2003a, b; Ricketson, 2003) by the unique glandular papillae of the corolla lobes and bright yellow anthers. During routine identifications of Myrsinaceae, a single collection of *Parathesis* from the Department of Valle del Cauca, Colombia, that had remained unidentified for 45 years, was revealed, and is described here.

Parathesis calimensis Ricketson & Pipoly, sp. nov. TYPE: Colombia. Dept. Valle del Cauca: Pacific coast, Río Calima, Quebrada de López, 20–40 m, 23 Sep. 1961 (fr), *J. Cuatrecasas & L. Willard 26040* (holotype, COL; isotype, US). Figure 1.

Ob folia fructosque magnos *Parathesem pseudocrassiramem* Ricketson & Pipoly arcte simulans, sed ab ea ramulis teretibus (non angulatis), laminis chartaceis (non coriaceis) atque desuper laevis (nec bullatis), petiolis 2.1–2.8 (non 2.8–3.6) cm longis, pedicellis 9.3–9.8 (non 1–2.5) mm longis, lobis calycinis 0.4–0.6 (non 1–1.4) mm latis praeclare cognoscitur.

Tree to 4 m tall. *Branchlets* stout, terete, 5–6 mm diam., scattered to densely appressed papillose or glandular-granulose or tomentose, glabrescent. *Leaves* with blades chartaceous, elliptic, ovate to oblong, 11.2–25.7 × 5.4–11.7 cm, apically acute, the acumen 0.8–1.2 cm, basally acute, decurrent on the petiole, inconspicuously punctate and punctate-lineate, adaxially glabrous, abaxially inconspicuously bizonal, tomentum of scattered to densely appressed, sessile, stellate trichomes especially along the midrib and secondary veins, glabrate or with tomentum scattered densely appressed, sessile, stellate trichomes along the margins, entire abaxial surface glabrate with age, the midrib impressed adaxially, prominently raised abaxially, the secondary veins in 23 to 30 pairs somewhat impressed adaxially, prominently raised abaxially, the margins entire, flat; petioles slender, marginate, 2.1–2.8 cm, glabrous above, appressed papillose or glandular-granulose or tomentose below, glabrescent. *Inflorescence* terminal and in the axils of the uppermost leaves, pinnate to bipinnate paniculate, 10–13 × 7–8 cm, pyramidal, much shorter than the leaves, the vestiture of the rachis as in the branchlets; corymbs 3- to 5-flowered; peduncles nearly absent to 1 cm long, the lower branches subtended by leaves; inflorescence bracts unknown; inflorescence branch bracts caducous, membranaceous to chartaceous, lineate to oblanceolate, 2.4–3 × 0.4–0.8 mm, apically

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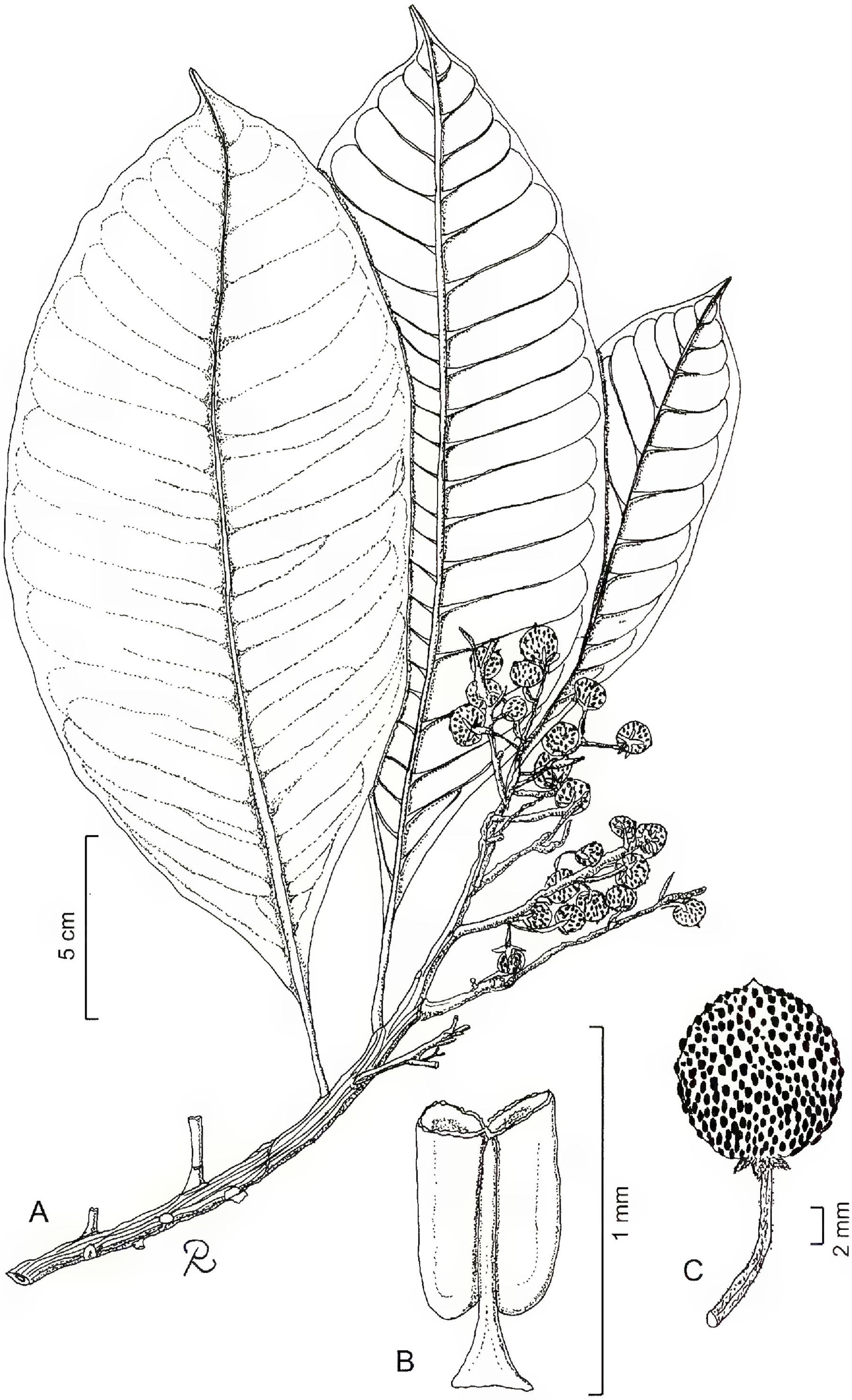

Figure 1. *Parathesis calimensis* Ricketson & Pipoly. —A. Floral branch. —B. Remnant of a stamen, showing the basal portion of the anthers and basifixed filament. —C. Fruit. Drawn from the isotype *J. Cuatrecasas & L. Willard 26040* (US).

acuminate, basally sessile, conspicuously and prominently punctate and punctate-lineate, glabrous adaxially, vestiture as in the branchlets abaxially, the veins inconspicuous, the margins entire; floral bracts caducous, chartaceous, triangular to ovate, 0.4–0.6 × 0.7–1 mm, apically long acuminate, basally sessile, conspicuously and prominently punctate and punctate-lineate, glabrous adaxially, vestiture as in

the branchlets abaxially, the veins inconspicuous, the margins entire; pedicels slender, angulate, 9.3–9.8 mm, inconspicuously punctate and punctate-lineate, vestiture as in the branchlets. *Flowers* 5-merous; calyx membranaceous to chartaceous, 1.3–1.5 mm, the tube 0.3–0.5 mm, the lobes triangular, 0.8–1.2 × 0.4–0.6 mm, apically acute, conspicuously and prominently punctate and punctate-lineate, glabrous adaxially, vestiture as in the branchlets abaxially, the veins inconspicuous, the margins entire; corolla unknown; stamens with incomplete information, known only from a single fragment, the apically free portion of the filaments 0.6–0.7 mm long, inconspicuously punctate and punctate-lineate, glabrous, the anthers yellow, basally sagittate, dorsifixed, the connective inconspicuously punctate and punctate-lineate; pistil incomplete, ovary ovate, 0.9–1.2 mm, conspicuously and prominently punctate and punctate-lineate, densely tomentose with appressed simple or stellate trichomes, style unknown, ovules unknown. *Fruits* globose, 8.6–9.1 mm diam., conspicuously and prominently punctate and punctate-lineate, glabrate with age, not costate.

Distribution. *Parathesis calimensis* is endemic to the area around Quebrada de López along the Río Calima, near the Pacific coast in the Department of Valle del Cauca, Colombia, growing from 20–40 m elevation.

Ecology and IUCN Red List category. *Parathesis calimensis* is an apparent point endemic. The existence of a single specimen collected in 1961 near a populated area points to the species' rarity (or extirpation). According to IUCN (2001) Red List criteria, this species would be Critically Endangered (CRB2aD), owing to (B) area of occupancy estimated to be less than 10 km^2 and (2a) known only from one collection, so (D) the total population size estimated at less than 50 mature individuals. Because *P. calimensis* occurs near populated areas, the extinction risk is increased; in addition there remains the possibility of threat from unforeseen factors (treefalls, storms, etc.).

Etymology. The specific epithet refers to the type locality along the Río Calima.

Discussion. According to Ricketson and Pipoly's (2003b) infrageneric classification for the genus *Parathesis*, *P. calimensis* belongs to *Parathesis* subg. *Parathesis* sect. *Cubanae* Ricketson & Pipoly, which is circumscribed by the tomentum of branchlets and abaxial leaf surface as fine, mostly sessile or subsessile stellate and usually closely appressed, sometimes subappressed and rather loose, often glabrescent; inflorescences terminal, pyramidal-paniculate; anthers erect, with longitudinal slits and/or subterminal pores, dorsifixed, usually near base, never versatile; filaments shorter than the anthers, often half as long. Although the type specimen is in fruit, fragments of flowers can be found in various forms still attached to the specimen. Such is the case for this material, a fragment and anther were discovered on the isotype, showing the lower half of an anther, with the filament still attached. Clearly the anther is dorsifixed and the filament is shorter than the anther, making its placement in section *Cubana* undeniable.

On account of its large leaves and fruits, *Parathesis calimensis* is most closely related to *P. pseudocrassiramea*, but may be recognized by its branchlets terete (vs. angulate), leaves chartaceous (vs. coriaceous), leaf blades not bullate (vs. bullate), petioles 2.1–2.8 cm long (vs. 2.8–3.6 cm long), pedicels 9.3–9.8 mm long (vs. 1–2.5 mm long), and calyx lobes 0.4–0.6 mm wide (vs. 1–1.4 mm wide).

Despite the somewhat scanty material, we feel confident in describing this species as it has not been seen or collected since the type gathering despite recent surveys in the area. Describing the entity will facilitate analysis of the family for Red Listing and alert collectors to its existence.

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Besleria beltranii (Gesneriaceae), a New Species from Peru

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ABSTRACT. A new species of *Besleria* L. (Gesneriaceae) is described and illustrated from Peru. This species is distinguished by having inflorescences composed of few (1 to 5) flowers, lanceolate calyx lobes with the apex acute, and the corolla strongly ventricose.

RESUMEN. Una nueva especie de *Besleria* L. (Gesneriaceae) del Perú es descrita e ilustrada. Esta especie se caracteriza por sus inflorescencias compuestas de pocas flores (1 a 5), lóbulos del cáliz lanceolados de ápice agudo y la corola fuertemente ventricosa.

Key words: *Besleria*, Gesneriaceae, Huánuco, IUCN Red List, Peru, San Pedro de Carpish.

Besleria L. is one of the Neotropical genera of Gesneriaceae with a high number of species, and so far 171 have been described (Kvist et al., 1998). The distribution of the genus ranges from southern Mexico to Bolivia and Brazil (Skog, 1996). Its center of diversity is located in northwest South America (Feuillet & Steyermark, 1999), where the highest concentration of species is found in Colombia with 40 species.

Peru has 35 species of *Besleria* (Kvist et al., 2005) and should be ranked second in species diversity. In Brako (1993), of the 32 species considered for Peru, 27 were treated as endemic. However, in recent studies (Salinas & León, 2006) only 18 species are considered endemic. *Besleria* does not have a modern taxonomic treatment, which implies that the real number of species for the country may be unknown.

During evaluation of the flora and vegetation of San Pedro de Carpish (Department of Huánuco), I collected specimens of an unknown species of *Besleria*. The study of this material leads me to the conclusion that the species is new for the science, and it is described below.

Besleria beltranii I. Salinas, sp. nov. TYPE: Peru. Huánuco: Prov. Huánuco, Chinchao, San Pedro de Carpish, 2 hrs. to Hacienda Paty, 09°41′59″S, 76°05′42″W, 2300 m, 17 Aug. 2002, *I. Salinas & M. Chocce 485* (holotype, USM; isotypes, MO, US). Figure 1.

Haec species a *Besleria barbata* (Poeppig) Hanstein inflorescentia 1- ad 5-flora, lobulis calycinis lanceolatis, acutis et corolla fortiter ventricosa, ca. 1.0 cm lata differt.

Shrub, 0.5–0.6 m tall; stems unbranched, subterete, 0.4–0.5 cm diam., cortex with longitudinal fissures, brown, glabrous, golden glabrescent to apically scabrose, internodes 2.0–8.5 cm. *Leaves* opposite to ternate, slightly unequal in pairs; petioles canaliculate, 1.2–3.5 cm, green, shortly sericeous to glabrescent; blades elliptic to ovate, 11.0–13.5 × 5.5–7.5 cm, apex acute to obtuse, cuneate to rounded at base, margins scattered denticulate, coriaceous; adaxially green, golden velutinous; abaxially yellowish green, shortly golden sericeous, 6 to 8 pairs of secondary veins. *Inflorescence* not pedunculate, cymose, axillary, with 1 to 5 flowers per node; pedicels terete, 0.8–1.2 cm, greenish brown, glabrescent to scattered pilose. *Flowers* zygomorphic; calyx lobes 5, lobes erect, basally imbricate, adpressed to the corolla, dorsally keeled, slightly equal, dorsal lobe lanceolate, ventral and lateral lobes narrowly lanceolate, 0.5–0.6 × 0.3–0.5 cm, apex acute, margin entire or sometimes ciliate, greenish brown, outside sparsely pilose, inside glabrous; corolla tube contracted in throat, limb regular, ca. 1.7 cm long, ca. 1.0 cm at the widest point, ca. 0.4 cm at the narrowest point, throat ca. 0.5 cm wide, dorsally and basally slightly gibbous, strongly ventricose, orange, outside glabrous, inside sparsely glandular-pilose from the ventricose surface until the throat; lobes 5, reflexed, slightly equal, semiorbicular, ca. 0.1 × 0.2 cm, margin entire, orange, glabrous; nectary annular, ca. 0.5 mm wide, glabrous; stamens 4, included; filaments 0.7–1.0 cm, epipetals, arising ca. 0.2 cm from the base of the corolla, glabrous; anthers ca. 0.1 × 0.2 cm, longitudinally dehiscent; ovary conical, ca. 0.4 × 0.2–0.3 cm, shortly pilose; style included, ca. 0.5 cm, shortly pilose; stigma bifid. *Fruit* a berry, globose, ca. 0.7 × 0.8 cm, glabrescent, calyx persistent; seeds numerous, ovoid to widely elliptic, ca. 1.0 × 0.5 mm, light brown to dark red, longitudinally striate.

Distribution and habitat. *Besleria beltranii* is only known from the type locality in San Pedro de Carpish, Peru. It grows in humid montane forests ranging from

Figure 1. *Besleria beltranii* I. Salinas. —A. Branch. —B. Flower. —C. Calyx. —D. Open flower. —E. Pistil. —F. Fruit. A–F drawn from the holotype *I. Salinas & M. Chocce 485* (USM).

2300 to 2400 m in elevation. Here, the forest reaches 20 m in height and is characterized by a conspicuous richness of epiphytes and profuse development of the understory. The vegetation is mainly composed of species of Melastomataceae, Cunoniaceae, Rubiaceae, Asteraceae, Cyatheaceae, Clusiaceae, Orchidaceae, Bromeliaceae, and Araceae as well as pteridophytes.

IUCN Red List category. The conservation status of *Besleria beltranii* was determined following IUCN Red List criteria (IUCN, 2001). It is treated under the category Endangered (EN B1a). The distribution of the species can be extended approximately 250 km^2, as we can assume the species is present in the surrounding forest of the Department of Pasco because of its similarity to the humid montane forest of Huánuco. The populations of *B. beltranii* are severely fragmented, with approximately five subpopulations. Studies in conservation should focus on the biology of the species and how it is impacted by the fragmentation of its habitat as a consequence of anthropogenic activities.

Phenology. The flowering period is from June to September, and fructification lasts from December to March.

Etymology. The specific epithet honors Hamilton Beltrán for his contribution to the knowledge of the Peruvian flora.

Discussion. Floral morphology is determinant to distinguish sections of *Besleria* (Morton, 1939, 1968), and according to Morton's treatment, *B. beltranii* belongs to section *Besleria* subsection *Sessiles* C. V. Morton where the calyx lobes measure less than half the length of the corolla, the common peduncle is obsolete, with a regularly shaped limb of the corolla and the contraction in the throat of the corolla as typical. *Besleria beltranii* is similar morphologically to *B. barbata*, which belongs to the same section and is known from Colombia, Ecuador, and Peru. While the inflorescence of *B. beltranii* is composed of few (1 to 5) flowers, the lanceolate calyx lobes have an acute apex, and the corolla tube is markedly ventricose (1 cm wide). In contrast, *B. barbata* has 10 to 25 flowers densely arranged, the calyx lobes are oblong with rounded apex, and the corolla tube is only slightly ventricose (0.4–0.5 cm wide). Vegetatively, *B. beltranii* is distinguished from *B. barbata* in its glabrous stems and leaf blades that are cuneate to rounded at the base; *B. barbata* presents a hirsute indumentum and leaf blades that are only cuneate at base.

Besleria beltranii may be confused vegetatively with *B. reticulata* Fritsch, a species that grows at the type locality, but the latter species has opposite leaves with the abaxial surface densely sericeous.

Besleria beltranii is added to other endemic species known from the humid montane forest of San Pedro de Carpish: *Miconia carpishana* Wurdack, *Oxalis salticola* Lourteig, *Nordenstamia rimachiana* (Cuatrecasas) B. Nordenstam, and *N. carpishensis* (Cuatrecasas) B. Nordenstam. It is also added to the 18 endemic species of *Besleria* from Peru (Salinas & León, 2006).

Paratypes. PERU. **Huánuco:** Huánuco, betw. Carpish & Paty, *C. Díaz & S. Baldeón 2252* (MO, USM); Dist. Chinchao, San Pedro de Carpish, Hacienda Paty, *I. Salinas & M. Chocce 418* (USM), *J. Clark, H. Beltrán & I. Salinas 8179* (US, USM), trail towards Hacienda Patti, *J. Clark, H. Beltrán & I. Salinas 8198* (US, USM), *J. Clark, I. Salinas & H. Beltrán 8226* (US, USM).

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Leucas sivadasaniana, a New Species of Lamiaceae (*Leucas* sect. *Astrodon*) from Peninsular India

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Abstract. The new species *Leucas sivadasaniana* Sunojkumar (Lamiaceae), collected from the Kudachadri Hills of Karnataka in Peninsular India, is described and illustrated. It is related to *L. beddomei* (Hooker f.) Sunojkumar & P. Mathew, *L. eriostoma* Hooker f., and *L. lamiifolia* Desfontaines, from which the new species differs in having broadly cuneate leaves, long and densely villous bracteoles, a nonciliate calyx mouth, and triangular teeth. This species is included in *Leucas* sect. *Astrodon* Bentham.

Key words: India, IUCN Red List, Karnataka, Lamiaceae, *Leucas*.

Worldwide, the genus *Leucas* R. Brown (Lamiaceae) comprises about 100 species and is found in the tropical regions of Africa, Arabia, and Asia (Sebald, 1980). In India, there are about 41 species—mostly distributed in the south—of which 23 are endemic. Two additional endemic species from this area were described recently by Sunojkumar and Mathew (2002) and Sunojkumar (2005). During collection for taxonomic studies of all the hitherto described Indian species, the author discovered a small population of *Leucas* at the margins of a mountain evergreen forest in the Kudachadri Hills of Karnataka, South India. This, when compared with specimens and types of related taxa, is confirmed to be a distinct species, which is described and illustrated here.

Leucas sivadasaniana Sunojkumar, sp. nov. TYPE: India. Karnataka: Udupi Dist., Kudachadri Hills, 1200–1400 m, 12 Feb. 2003, *P. Sunojkumar CU88126* (holotype, CALI; isotypes, K, MH, MO). Figure 1.

Leucadi beddomei (Hooker f.) Sunojkumar & P. Mathew, *L. eriostomati* Hooker f., et *L. lamiifoliae* Desfontaines arcte affinis, sed foliis basi late cuneatis, bracteolis triangularibus, villosis, non involucratis, ore calycis sine ciliis, lobo medio labii profunde emarginato differt.

Stout shrub, erect, 1–1.75 m tall, stem base 3–5 cm diam., ligneous with thick periderm, profusely branching; branches obtusely angular, grooved, long-tomentose to villous, hairs erect, silvery, 2–2.5 mm; internode 6–11 cm, tender stems densely villous. Leaves opposite, decussate; petiole 1.5–2.5 cm, villous; lamina lanceolate, 7–13 × 2.5–4 cm, 2.5× longer than broad, coriaceous, acute, base broadly or narrowly cuneate, margin serrate with 20 to 23 teeth, secondary veins 9 to 10, abaxial surface densely hispid, hairs 2 mm, spreading, mainly on the veins, adaxial surface villous, hairs 2 mm, glandular-punctate, margin ciliate. Inflorescence terminal, of 3 to 4 verticillasters, densely flowered, subglobose, 3–4 cm wide; bracteoles lanceolate, 1.3–1.5 × 0.2–0.25 cm, as long as calyx, many, densely villous, divergent below the inflorescence, not forming an involucre, apex acute, margin outside densely villous; flowers 20 to 30 per verticillaster, pedicels 1–2 mm. Calyx tubular, 1.3–1.5 cm, base narrowed, widest at middle, throat slightly constricted, outside fully tomentose, upper 1/2 outside ribbed at the veins, hispid, hairs 1–1.5 mm, inside upper 2/3 hispid with ca. 1 mm hairs, mouth straight, cilia absent; teeth 10, reflexed, alternately long and short, 2–3 mm, triangular, base 1–1.5 mm broad, tip acute, outside long-tomentose, hairs ca. 1 mm, inside short-pubescent; corolla white, 17–18 mm, tube 10–11 mm, included in the calyx tube, glabrous outside, inside a tuft of fleshy short hairs forming an annular ring ca. 7 mm from the corolla base; lower lip 8–9 mm, middle lobe 4–4.5 mm broad at free end, emarginate, lateral lobes ca. 2 mm broad; upper lip ca. 8 mm long, concave, strongly bearded with dense white, spreading hairs, margin ciliate; staminal filaments hairy at middle, upper stamen pair shorter than the lower pair; anthers deep red, ca. 1.8 × 0.57 mm; disc cup-shaped, ca. 1.5 mm tall, lobes almost equal; ovary locules ca. 1.2 mm, rounded on the upper side; style 15–16 mm, stigma bilobed, lower lobe ca. 0.7 mm, upper ca. 0.06 mm. Nutlets ca. 4 × 2 mm at middle, dark black, shining, oblong, base narrowed, top almost rounded, broadly trigonous in cross section.

Distribution and ecology. *Leucas sivadasaniana* is endemic to southern Western Ghat, from a population of less than 100 plants known from a single locality in the Kudachadri Hills of Udupi District in Karnataka. The new species is found in the margins of mountain evergreen forests at altitudes between 1200 and 1400 m.

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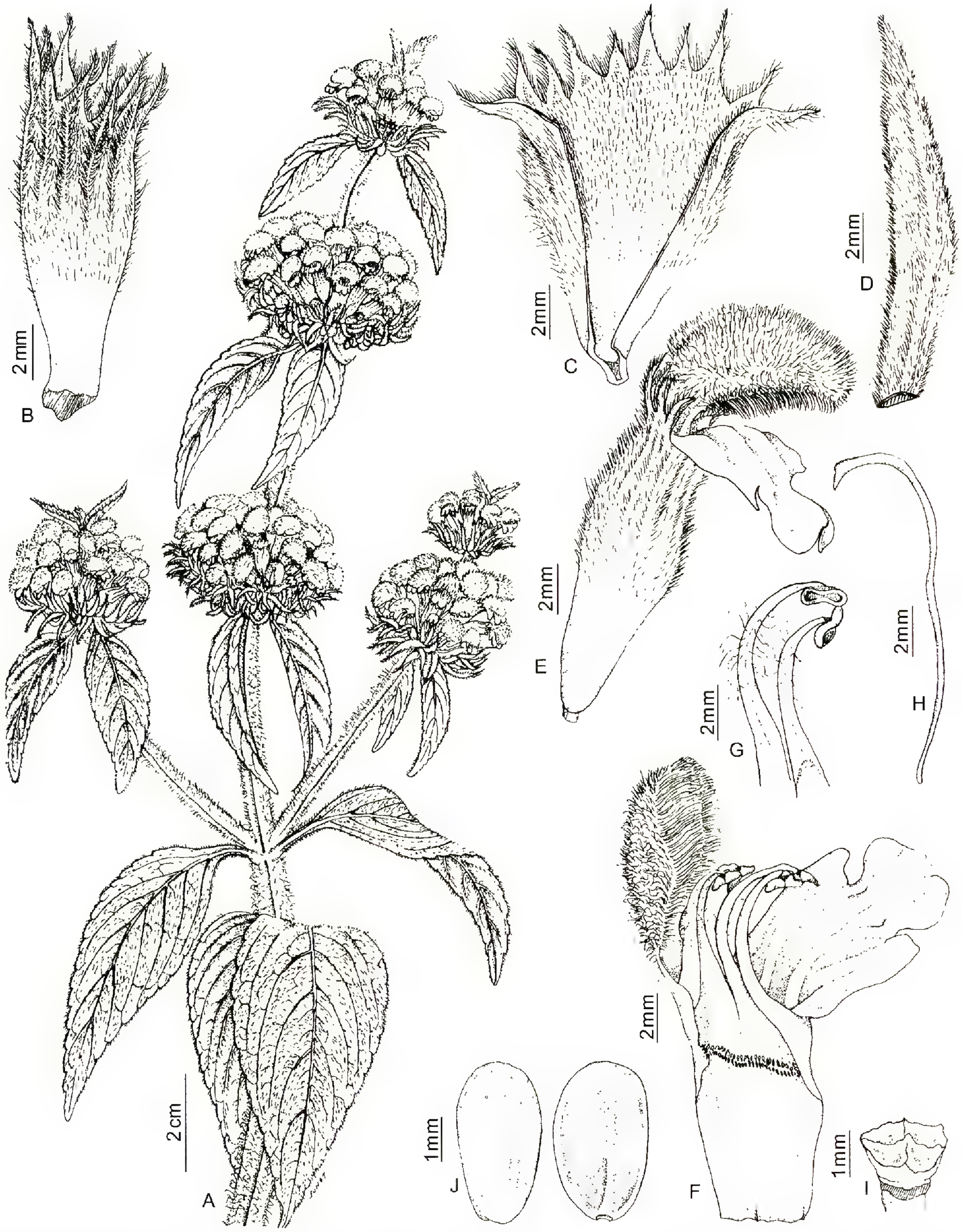

Figure 1. *Leucas sivadasaniana* Sunojkumar. —A. Habit. —B. Calyx. —C. Calyx split open. —D. Bracteole. —E. Flower. —F. Corolla split open. —G. Stamens. —H. Style. —I. Basal disc. —J. Nutlets. Drawn from the type *Sunojkumar CU88126* (CALI).

IUCN Red List category. Its occurrence in the Kudachadri Hills, inside the Mookambika Wildlife Sanctuary guarantees the preservation of this species in the near future. Based on IUCN Red List criteria (IUCN, 2001), *Leucas sivadasaniana* can be given the conservation status of Critically Endangered (CR B1ab[ii,iii]) due to its restricted occurrence area, habitat loss, and population size.

Phenology. Observed as flowering in December; fruiting from January to March.

Etymology. The species is named after M. Sivadasan (1948–), Professor of Botany, University of Calicut, Kerala, India, in appreciation for his contributions to plant taxonomy.

Discussion. *Leucas sivadasaniana* is found over a 10-km^2 area, in the Kudachadri Hills in Mookambika Wildlife Sanctuary, and no related taxa are reported from this area. In its shrubby nature, it is similar to other South Indian endemic species such as *L. beddomei*, *L. eriostoma*, and *L. lamiifolia*, which are

Table 1. Comparison between *Leucas sivadasaniana* and related species.

Character	*L. lamiifolia*	*L. sivadasaniana*	*L. eriostoma*	*L. beddomei*
Habit	shrub, 1–1.5 m tall	stout shrub, 1–1.75 m tall	subshrub, 0.45–1 m tall	shrub, 0.75–1 m tall
Lamina	ovate, 6–13 × 3–6 cm	lanceolate, 7–13 × 2.5–4 cm	linear-lanceolate, 6–9 × 1–1.5 cm	elliptic, 5–10 × 2–3 cm
Leaf base	rounded to cordate	broadly to narrowly cuneate	narrowly cuneate	narrowly cuneate
Bracteoles	bent toward the flowers, involucrate, thin, margin ciliate, outside hispid, 10–13 × 1.5 mm	diverging below, not involucrate, thick, margin outside densely villous, 13–15 × 2–2.5 mm	erect, not involucrate, thin, margin ciliate, 6–8 × 0.3–0.5 mm	erect, not involucrate, thin, margin ciliate, 7–8 × 1 mm
Calyx	0.8–1 cm, thin, inside glabrous	1.3–1.5 cm, thick, fleshy, inside upper 2/3 hispid	0.5–0.6 cm, upper 1/2 thin reticulate, lower 1/2 thick leathery, inside glabrous	0.7–0.8 cm, thick, fleshy, inside glabrous
Calyx mouth	ciliate with long hairs turned toward the mouth, rim annulate with a thick ring of veins	not ciliate, open, not annulate	ciliate with long hairs turned toward the mouth, rim annulate	ciliate with short hairs, rim annulate
Calyx teeth	linear, midvein not distinct, 2–2.5 × 0.5 mm	triangular, midvein thick, ribbed, 2–3 mm, base 1–1.5 mm broad	spinescent, 0.6–0.8 × 0.5 mm	triangular, 0.9–1 × 0.5 mm
Corolla lower lip, middle lobe	fan-shaped, 8–8.5 × 5–6 mm	emarginate, a deep fissure equally dividing the lobe, 8–9 × 4–4.5 mm	emarginate with equal lobes, 4–4.5 × 2.5–3 mm	emarginate with equal lobes, 3.5–4 × 2–2.5 mm
Corolla upper lip	golden brown	cottony white	silvery white	golden yellow
Corolla tube inside (above annulus)	glabrous	glabrous	with dense, fleshy, longitudinal rows of hairs	with dense, fleshy, longitudinal rows of hairs

found ca. 250–490 km away, in very restricted distributions. However, *L. sivadasaniana* is distinguished by unique floral and vegetative characters, and possesses the largest flowers and bracteoles recorded in the genus. A number of herbaria (CAL, CALI, K, MH, SKU, TBGT) where other plant specimens from this area are deposited were visited to confirm the novelty of this taxa. Due to similar characters such as shrubby habit, inflorescence position toward the branch tip, and the tubular calyx, this new species is included in *Leucas* sect. *Astrodon* Bentham. It can be easily distinguished from related species by the characters shown in Table 1.

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Rubiacearum Americanarum Magna Hama Pars XX. New Species of *Faramea* (Coussareae) from Central and South America

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Abstract. Seven new species of *Faramea* Aublet (Rubiaceae, Coussareae) are newly described from Colombia, Ecuador, Panama, and Peru. The new species *F. colombiana* C. M. Taylor from northwestern Colombia differs from *F. robusta* C. M. Taylor by its longer pedicels and larger flowers; *F. condorica* C. M. Taylor from southeastern Ecuador differs from *F. phyllonomoides* Standley by its longer calyx limbs and corollas with the tubes about twice as long as the lobes; *F. frondosa* C. M. Taylor from Panama differs from *F. eurycarpa* Donnell Smith by its oblanceolate to obovate calyx lobes 3.5–7 mm long; *F. melicoccoides* C. M. Taylor from western Colombia is distinguished by its relatively large fruits with a thickened pericarp, juicy mesocarp, and single smooth seed; *F. ortiziana* C. M. Taylor from Amazonian Peru differs from *F. guianensis* (Aublet) Bremekamp by its often terminal inflorescences and larger flowers and fruits; *F. robusta* C. M. Taylor from northwestern Colombia differs from *F. polytriadophora* Bremekamp by its longer peduncles and larger flowers; and *F. schunkeana* C. M. Taylor from central Peru differs from *F. morilloi* Steyermark by its leaves obtuse to rounded or cordulate at base, its larger corollas, and its smooth seeds.

Key words: Colombia, Coussareae, Ecuador, *Faramea*, IUCN Red List, Neotropics, Panama, Peru, Rubiaceae.

During study of recent collections of *Faramea* Aublet from Central and South America, the following undescribed taxa were discovered. A summary of the morphology of *Faramea* has previously been presented (Taylor, 1999, 2002). This Neotropical genus of about 130 species of understory shrubs is characterized within the Rubiaceae by its indehiscent, often leathery, blue to black fruits with one rather thin-walled seed; its ovaries 1-locular with one basal ovule; and its internally glabrous corollas with four valvate lobes. Additionally, *Faramea* can often be recognized by its stipules that usually terminate in a well-developed arista and are often also costate; its flattened stems with a slender longitudinal ridge descending along each side as an apparent continuation of the stipule rib; and its distichous leaf arrangement. The inflorescences are notably variable, with flowers solitary to numerous, axillary and/or terminal, and variously cymose to capitate or fasciculate with bracts well developed to reduced. Species of *Faramea* grow in moist to wet forests at 0–3200 m; many if not most of them are distylous.

Faramea is similar to *Coussarea* Aublet; *Coussarea* is distinguished by its usually white inflorescence axes (vs. green to blue) and fruits with spongy mesocarp and white surfaces (vs. fleshy to juicy and blue to black, respectively). *Faramea* has not been studied as a whole, but several floristic treatments have been presented (e.g., Taylor, 1999, 2004); additional comments on the characteristics, range, and classification of this genus were presented by Taylor (2002).

The study presented here is taxonomic and floristic; the objective is enumeration of the species that belong to various Rubiaceae genera, and the species that occur in the area of tropical Central and South America. The methods employed here correspond only to this objective; however, this study is based on survey of specimens collected over more than 60 years using various survey methods aimed at various objectives. The specimens that here outline the range and commonness of these new species were located through a non-exhaustive survey of a few herbaria. No field studies have been done either targeting these species or broadly surveying their occurrence in regions where they are known to grow or may be expected to occur (e.g., as in Cheek & Csiba, 2002). Thus, the floristic information presented here is a simplified presence report based on an incomplete survey of the data available, and the botanical data are uneven and incomplete for this region (Schulman et al., 2007). Knowledge of the range of a species is essential to understanding the threats to its existence and thus to understanding its actual conservation status; no claim is made here to accurately describe the entire geographic range of any of these new species. Knowledge of the existence of a species based only on one or a few collections does not provide a reasonable estimate of its population size,

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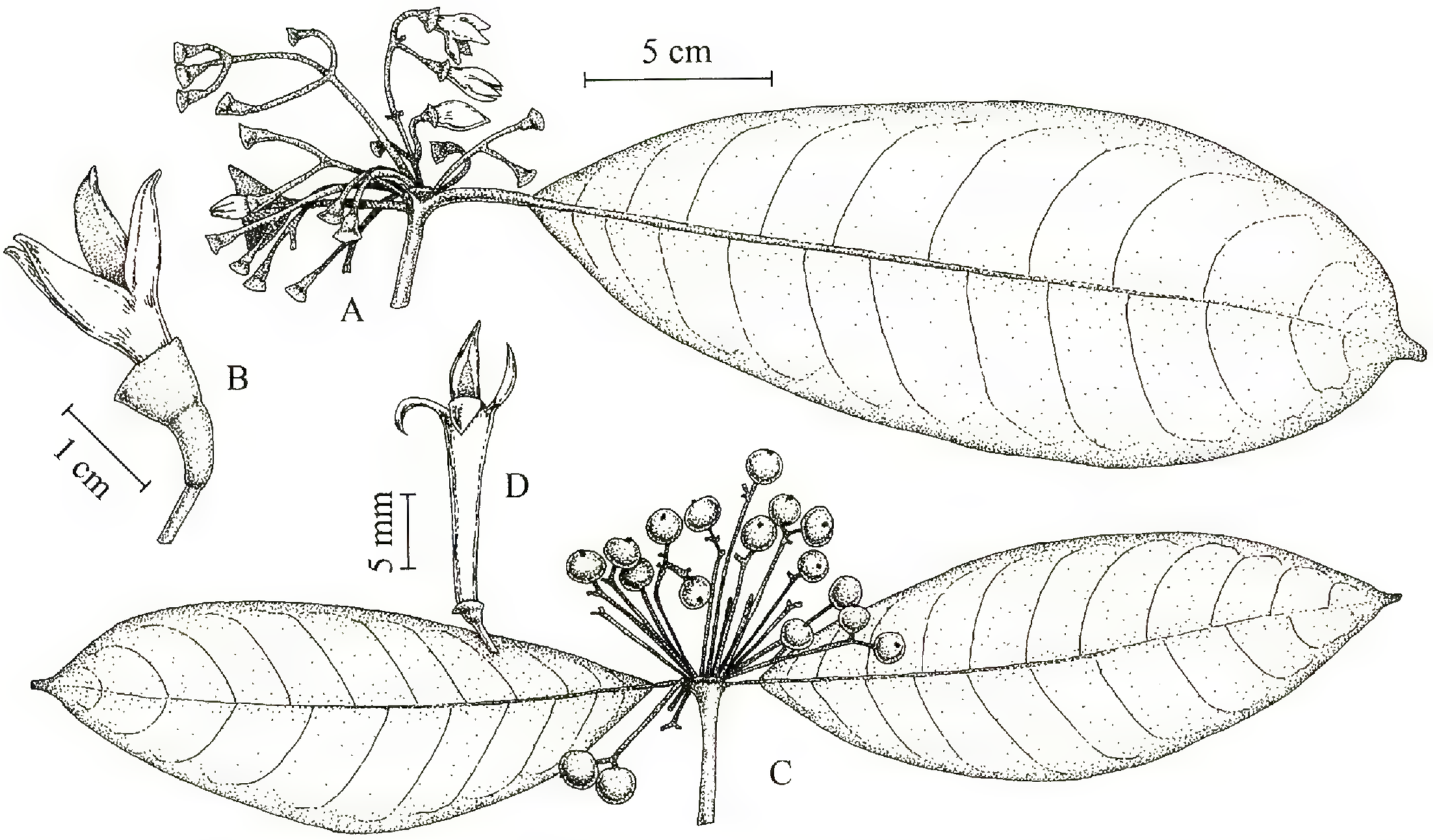

Figure 1. A, B. *Faramea colombiana* C. M. Taylor. —A. Flowering stem. —B. Flower at anthesis. C, D. *Faramea robusta* C. M. Taylor. —C. Fruiting stem. —D. Flower at anthesis. A, B based on the type, *Haught 4597*; C based on a paratype, *F. García 463*; D based on the type, *Tuberquia et al. 494*. A, C to 5-cm scale.

which is also essential to understanding its actual conservation status. Pro forma conservation assessments are provided here for these newly described species according to IUCN categories (IUCN, 2001) and following current taxonomic practices, but these assessments are not intended to be submitted to IUCN for acceptance and the basis for these assessments should be carefully evaluated by the reader.

1. **Faramea colombiana** C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: 6 km S of Guapá & ca. 60 km S of Turbo, ca. 60 m, 24 Apr. 1945, *O. Haught 4597* (holotype, US 1709167; isotypes, COL, F 1175415, US 1709166). Figure 1A, B.

Haec species a *Faramea robusta* C. M. Taylor pedicellis 8–20 mm longis, calycis limbo 3–4 mm longo atque corollae tubo 7–8 mm longo ac lobulis 10–11 mm longis distinguitur.

Small trees to 7 m tall, glabrous. *Leaves* elliptic to elliptic-obovate, 16–34 × 8–16 cm, at apex rounded then abruptly acuminate with tips 6–10 mm, at base cuneate to obtuse, drying chartaceous to subcoriaceous, adaxially shiny, abaxially matte to somewhat shiny; secondary veins 9 to 15 pairs, looping weakly to interconnect, adaxially venation plane or costa sometimes prominent, abaxially costa prominent, secondary veins plane to prominulous, and higher order venation plane; petioles 15–25 mm; *stipules* united around the stem, persistent, 5–15 mm, abaxially smooth (i.e., without ribs), truncate to broadly rounded, aristate with arista ca. 2.5 mm. *Inflorescences* terminal, fasciculate, 8–10 × 8.5–9 cm, glabrous, ebracteate or bracts reduced; peduncles 7 to 8, 2–3.5 cm, with branched portion 1.5–8 cm, branched to 1 or 2 orders, unarticulated; pedicels 8–20 mm. *Flowers* with hypanthium cylindrical, 3–3.5 mm; calyx limb 3–4 mm, truncate; corolla white, fleshy, glabrous externally and internally, tube funnelform, 7–8 mm, lobes triangular to lanceolate, 10–11 mm, acute to acuminate; anthers and stigmas not seen. *Infructescences* similar to inflorescences. *Fruits* subglobose, ca. 15 mm diam., color unknown; seed smooth.

Distribution, habitat, and phenology. Wet forests at 30–60 m in northwestern Colombia; collected with flowers in April, with immature fruits in June.

Conservation assessment. This species is documented so far by two collections that were distributed to North American herbaria, one collected more than 40 years ago and the other more than 20 years ago. These were both collected in the same general region; neither of the collection sites can be located exactly. This general area has not been explored botanically in the past 20 years, or at least specimens have not been distributed to North American herbaria. The possible occurrence of this species in other sites is unknown. The vegetation of the areas where these specimens were collected is presumed to be degraded, because

most areas accessible to collectors 20 or more years ago are now degraded. Other species of northwestern South American Rubiaceae considered locally endemic have later been found widely distributed (e.g., Taylor, 1999), although these distributions have not always been documented with specimens due to various factors, including government restrictions on collecting specimens (e.g., *Duroia sancti-ciprianii* Devia, C. Persson & C. M. Taylor is documented only from Valle Department, Colombia, but is also frequent in disturbed forests near Quibdó, Chocó, where it has not been collected, apparently because it grows close to urban development; pers. obs.). Because these considerations counter each other, this species is here considered Data Deficient (DD; IUCN, 2001).

Discussion. *Faramea colombiana* is notable for its rather large firm-textured leaves, its unusual inflorescences composed of a terminal group of seven or eight fasciculate peduncles each bearing three to five flowers, its well-developed truncate calyx limb, and its stout white corollas with the lobes about equal in length to the tube. This new species is known only from the region of the Bahía Colombia at the base of the Golfo de Urabá, an inlet of the Caribbean Sea located at the southern end of the Panamanian isthmus; the specific epithet refers to this region. The name "*Coussarea locuples*" was annotated on the collection *Haught 4597* by Standley, but this name was eventually published by him for a very different species from Amazonian Brazil. This new species is similar to *F. robusta* C. M. Taylor (described herein), also found in northwestern Colombia, which has a similar inflorescence arrangement; *F. robusta* differs in its more numerous (14 to 18) and apparently more slender peduncles, its calyx limbs ca. 1 mm long, and its corolla with the tubes ca. 18 mm long and much longer than the lobes. This new species is also similar to *F. cyathocalyx* Standley, also of northwestern Colombia; *F. cyathocalyx* has one to four (or possibly more) flowers borne from the leaf axils or stem apex in a fasciculate group, each on a peduncle 1–25 mm long, with calyx limbs 7–11 mm long. Haught's first set of collections appears to have been deposited at US, and this is the best specimen of the set he made of his number *4597* and is therefore chosen as the holotype.

Paratype. COLOMBIA. **Antioquia**: Zona Bohios, Finca La Cabaña, camino al Río León, *E. Rentería y otros [sic on label] 4209* (JAUM, MO).

2. Faramea condorica C. M. Taylor, sp. nov. TYPE: Ecuador. Zamora-Chinchipe: Pachicutza, sendero hacia el Hito, 1000–1200 m, 18 Oct. 1991, *J. Jaramillo 14095* (holotype, NY). Figure 2D–F.

Haec species a *Faramea phyllonomoides* Standley calycis limbo longiore atque corollae tubo lobulis subduplo longiore distinguitur.

Shrubs or small trees to 4 m tall, glabrous. *Leaves* elliptic-oblong to lanceolate-oblong, 9–19 × 3.5–7 cm, at apex acute to acuminate with tips 5–10 mm, at base obtuse to rounded, truncate, or cordulate, drying papyraceous to chartaceous, adaxially and abaxially matte; secondary veins 7 to 15 pairs, looping to interconnect, forming a weak undulating submarginal vein, adaxially and abaxially costa prominent and remaining venation prominulous; petioles 2–10 mm; *stipules* united around stem, on each side 13–26 mm, abaxially smooth to costate, at apex triangular, apiculate, persistent, often splitting along one side. *Inflorescences* terminal, cymose, 3–4 × 3–4 cm, glabrous, sessile and tripartite, branched to 2 or 3 orders; bracts triangular to ligulate, 1–2.5 mm, rounded to acute or erose; pedicels 0.5–2.5 mm. *Flowers* subsessile to pedicellate in cymose groups of 3 to 9; hypanthium cylindrical to ellipsoid, 1–1.5 mm; calyx limb with tube 2–2.5 mm, truncate to concave between lobes, lobes narrowly triangular to linear, 1–2.5 mm; corolla salverform, white or flushed with lavender, glabrous externally and internally, tube 10–12 mm, lobes narrowly elliptic to lanceolate, ca. 5 mm, acute; anthers and stigmas not seen. *Infructescences* similar to inflorescences. *Fruits* oblate and laterally somewhat flattened, ca. 8 × 12–15 mm, blue; seeds smooth.

Distribution, habitat, and phenology. Wet forests at 800–1600 m in southeastern Ecuador and northern Peru, in the Cordillera del Cóndor and the Cordillera de Cutucú; collected with flowers in October, with fruits in February, March, and July.

Conservation assessment. This species is known from two phytogeographically related but physically separated mountain ranges. It is documented by a number of collections from unsystematic, generalized botanical surveys made over a decade in these two separated areas with different collectors all locating it. Thus, this species appears to be rather frequent and its populations do not appear to be declining, and it is here considered Least Concern (LC; IUCN, 2001).

Discussion. *Faramea condorica* can be recognized by its well-developed stipules that generally persist at least on the upper several nodes, its cymose, rather congested (i.e., with relatively short axes) terminal inflorescences, and its well-developed calyx limbs. It is only known from the Cordillera del Cóndor and Cordillera de Cutucú, which are sandstone outcrops

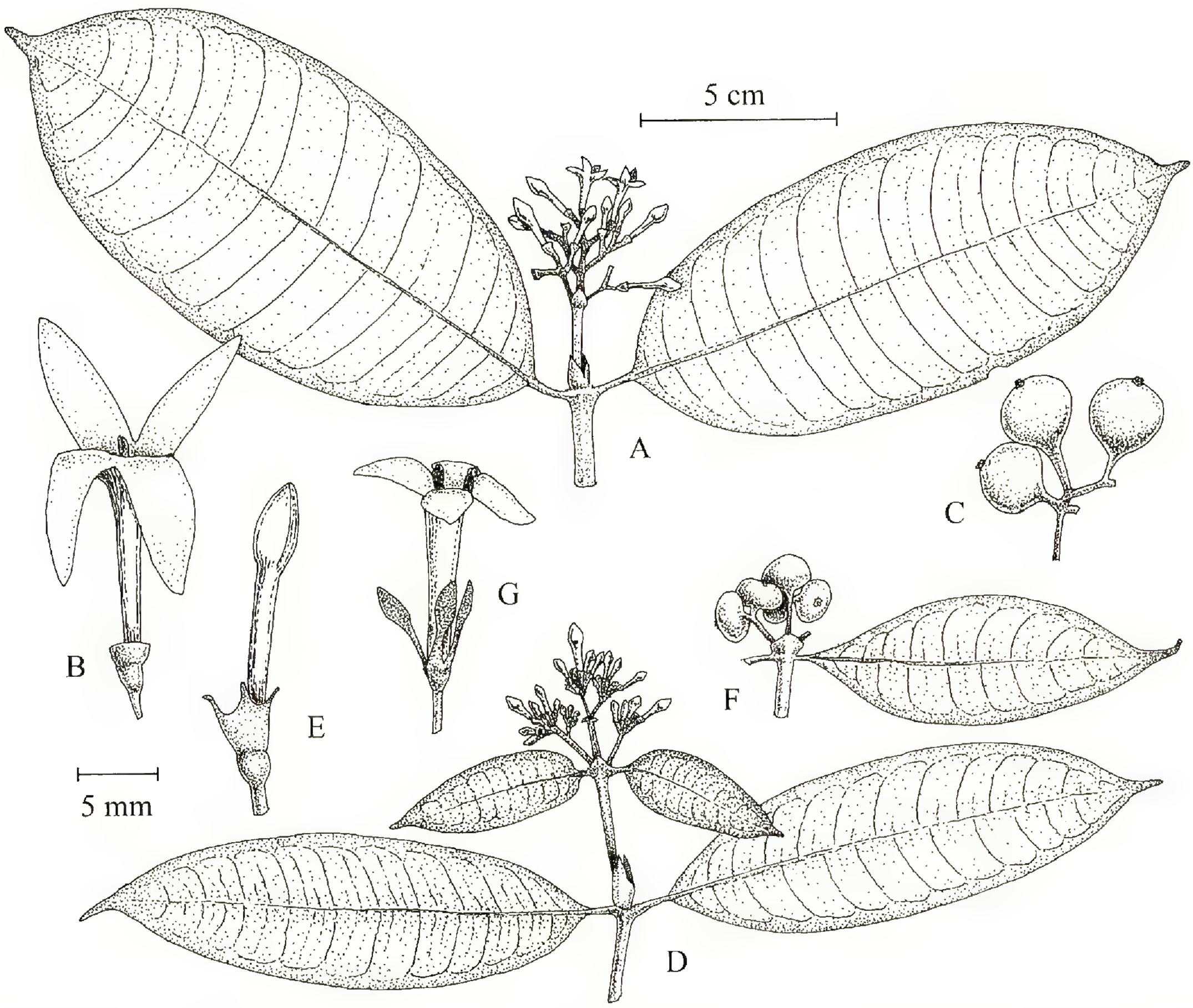

Figure 2. A–C. *Faramea melicoccoides* C. M. Taylor. —A. Flowering stem. —B. Flower at anthesis. —C. Portion of infructescence with three immature fruits. D–F. *Faramea condorica* C. M. Taylor. —D. Flowering stem. —E. Flower in bud. —F. Fruiting stem. —G. *Faramea frondosa* C. M. Taylor, flower at anthesis. A, C, D, F based on 5-cm scale; B, E, G to 5-mm scale. A, B based on the type, *Croat 61285*; C based on a paratype, *Croat 71105*; D based on the type, *Jaramillo 14095*; E based on a paratype, *Toasa 8954*; F based on a paratype, *Quizhpe 1754*; G based on *McPherson 12160*, the type and the only known specimen of this species.

that lie just east of the Andes in the Amazonian Basin of Ecuador; the specific epithet refers to the geographic distribution. Plants from the Cordillera de Cutucú have leaves that are rounded to truncate or cordulate at the base (e.g., *Harling & Ståhl 26923*), while plants from the Cordillera del Cóndor have leaves that are obtuse to rounded at the base (as in the type; cf. Fig. 2D, F). However, no other differences are evident between these populations, which are here treated as conspecific. This new species is similar to *F. phyllonomoides*; however, *F. phyllonomoides* has shorter calyx limbs, with the tubular portion 0.5–1 mm long, and shorter corollas with the tubes (4–5 mm long) shorter than the lobes (7–8 mm long). [*Faramea uncinata* C. M. Taylor (Taylor, 1999) is a synonym of *F. phyllonomoides* (Taylor, 2005).]

Paratypes. ECUADOR. **Morona-Santiago**: Cordillera de Cutucú, Patuca–Santiago rd., E of Río Namangoza, Km 35, *L. Dorr & L. Barnett 5849* (MO), new rd. Patuca–Morona, Km 20, "Piantza," *G. Harling & B. Ståhl 26963* (GB, S), rd. Méndez–Morona, *H. van der Werff & W. Palacios 10350* (MO); Cordillera del Cóndor, valle del Río Coangos, Río Psurim entre los centros Shuar de Numpatkain y Banderas, *P. Fuentes, J. Ronquillo & A. Tankamash 1143* (MO), Limón Indanza, cumbre del Cerro Chikichiki Naint a 4 km al SE del Centro Shuar Warints, *G. Toasa 8954* (MO). **Zamora-Chinchipe**: Cordillera del Cóndor, Nangaritza cantón, Río Nangaritza, camino al hito de Pachicutza, *W. Palacios & Exp. Tratado Cooperación Amazónica 8205* (MO); Yantzaza, carr. desde Los Encuentros hacia el Cerro Machinaza, sector San Antonio, *W. Quizhpe 1754* (MO). PERU. **Amazonas**: Cordillera del Cóndor, prov. Condorcanqui, Puesto de Vigilancia Alfonso Ugarte (PV 3), cabeceras del Río Comainas, tributario al O del Río Cenepa, *H. Beltrán & R. Foster 790* (F, MO).

3. **Faramea frondosa** C. M. Taylor, sp. nov. TYPE: Panama. Coclé: above El Valle, along trail to top of Cerro Gaital, 8°37′N, 80°07′W, 1000–1100 m, 24 Feb. 1988, *G. McPherson 12160* (holotype, MO 37562841). Figure 2G.

Haec species a *Faramea eurycarpa* Donnell Smith limbo calycino fere ad basin lobato lobulis oblanceolatis usque obovatis 3.5–7 mm longis distinguitur.

Small trees to 3.5 m tall, glabrous. *Leaves* elliptic-oblong, 8–12 × 3–4.5 cm, at apex acuminate with tips 8–15 mm, at base cuneate to obtuse, drying chartaceous, adaxially and abaxially matte; secondary veins 8 to 10 pairs, looping to interconnect along entire length of blade, forming an undulating submarginal vein, adaxially costa prominent and remaining venation plane, abaxially costa prominent and remaining venation plane to prominulous; petioles 5–8 mm; *stipules* united around the stem, persistent only on the apical 1 or 2 nodes, on each side 10–11 mm, abaxially smooth, at apex triangular and aristate, arista ca. 2.5 mm. *Inflorescences* terminal, cymose, ca. 4 × 5 cm, glabrous, sessile and tripartite, ebracteate or bracts reduced, branched to 3 orders, pale blue; pedicels 3–5 mm. *Flowers* with hypanthium cylindrical to subglobose, ca. 1.5 mm; calyx limb lobed nearly to base, lobes oblanceolate to obovate, 3.5–7 × 1–2.5 mm, usually a little unequal in length on an individual flower, obtuse to acute; corolla salverform, pale blue, glabrous externally and internally, tube ca. 12.5 mm, lobes elliptic, ca. 5 mm, acute; anthers ca. 5 mm, partially exserted; stigmas not seen. *Infructescences* and *fruits* not seen.

Distribution, habitat, and phenology. Wet forests at 1000–1100 m in western Panama; collected with flowers in February.

Conservation assessment. This species is known from one specimen made on a general floristic survey ca. 20 years ago. The region is botanically poorly known in general, and has not been much explored since. The mountains and Caribbean coast of western Panama continue to yield new botanical records, often of species previously known from the poorly explored Caribbean slopes of southern Costa Rica (e.g., *Osa pulchra* (D. R. Simpson) Aiello; Aiello et al., 2007). The restriction of *Faramea frondosa* to one small population in one site mandates an assessment of Critically Endangered (CR), but there is a realistic possibility of the occurrence of this species elsewhere and the size of the population is unknown, thus it is considered Data Deficient (DD; IUCN, 2001).

Discussion. *Faramea frondosa* is distinguished by its unusual calyx limb, which is relatively well developed and lobed nearly to the base, with the lobes markedly broadened at the apex. *Faramea frondosa* is very similar to *F. eurycarpa*, including in its dried leaves that are markedly yellow-green on the undersides, but the calyx limb of *F. eurycarpa* is 1–3 mm long and dentate with the teeth less than half its length. This new species is known from only one collection, apparently without duplicates in Panama (M. Correa, pers. comm.), but the unusual calyx limbs are unique in *Faramea*; the specific epithet refers to this feature. The one collection of this species resembles the short-styled form of distylous species of *Faramea*, with the anthers partially exserted and the stigmas included; whether this species is actually distylous cannot be determined from this one collection.

4. Faramea melicoccoides C. M. Taylor, sp. nov. TYPE: Colombia. Valle del Cauca: Bajo Calima, within forestry concession of Cartón de Colombia, betw. Buenaventura & Río Calima, 6.5 km beyond Portón Tomar (at Km 27), 22.3 km beyond Camp Portada Pulpapel, 33.3 km beyond main Cali–Buenaventura Hwy., 4°02′N, 77°07′W, 6 July 1986, *T. B. Croat 61285* (holotype, MO 3624565; isotypes, CUVC, NY). Figure 2A–C.

Haec species a congeneris fructu sat grandi pericarpio incrassato, mesocarpio succoso atque semine solitario laevi distinguitur.

Shrubs or small trees to 8 m tall, glabrous. *Leaves* elliptic-oblong, 10–17 × 3–8 cm, at apex acute to usually acuminate with tips 8–15 mm, at base obtuse to rounded, drying chartaceous, adaxially and abaxially matte; secondary veins 12 to 15 pairs, looping to interconnect along entire length of blade, forming an undulating submarginal vein, adaxially costa prominent and remaining venation plane, abaxially costa prominent and secondary veins prominent and remaining venation prominulous; petioles 8–15 mm; *stipules* united around the stem, quickly deciduous or persistent only on the apical 1 or 2 nodes, on each side 7–17 mm, abaxially smooth, at apex triangular and often apiculate. *Inflorescences* terminal, cymose, 12- to 35-flowered; peduncles 1.8–3 cm; branched portion corymbiform, 3–4.5 × 4–6 cm, branched to 3 orders, pale blue; bracts triangular to ovate, 0.5–1.5 mm; pedicels 2.5–8 mm. *Flowers* pedicellate in dichotomous or umbelliform groups, fragrant; hypanthium cylindrical to turbinate, ca. 1.5 mm; calyx limb ca. 1 mm, truncate or denticulate, teeth minute to 0.3 mm, often unequal on an individual flower; corolla salverform, pale blue, glabrous externally and internally, tube cylindrical in lower portion to shortly funnelform at throat, 12–14 mm, lobes elliptic to lanceolate, 8–10 mm, acute; anthers ca. 6 mm, included, tips apiculate, positioned just below corolla throat; stigmas ca. 2 mm, positioned in corolla throat. *Infructescences* similar to inflorescences, with 2 to 5 fruits developing. *Fruits* oblate, laterally somewhat

flattened, ca. 12 × 20 mm, blue to purple, pericarp leathery, mesocarp juicy and pulpy; seeds smooth.

Distribution, habitat, and phenology. Wet forests at 0–100 m in western Colombia; collected with flowers June–September, with fruits throughout the year.

Conservation assessment. This species is known from a number of collections from at least six different localities distributed through a somewhat localized area in western Colombia. These collections were made from over 60 years ago to ca. 15 years ago, when general botanical survey work in this region stopped due to problems of safe access and government restrictions on collecting. This species thus appears to be persisting widely through this area and rather common where it occurs (cf. multiple collections from several sites). Some of the localities are known to be disturbed to degraded, although secondary species such as this survive, but at least one site, Escalerete, has long-term preservation and this species is likely to be more widely distributed, but surrounding areas have not been explored botanically. Thus, this species is here considered Least Concern (LC; IUCN, 2001).

Discussion. *Faramea melicoccoides* can be recognized by its stiff-textured leaves with the venation all raised on the lower surface, its cymose terminal inflorescences with blue salverform flowers, and its distinctive fruits. The fruits are unusual in *Faramea* in being relatively large and with a thickened pericarp, juicy mesocarp, and single smooth seed; in these features they resemble *Melicoccus bijugatus* Jacquin (Sapindaceae), and the specific epithet refers to this similarity. Very few flowering collections have been seen; the flowers seen appear to resemble the long-styled form of distylous *Faramea* species. The corollas are rather unusual in *Faramea* in having the throat portion shortly but markedly dilated and spreading; in most *Faramea* species the tube is cylindrical and only the lobes spread, with the change in orientation located at their bases. This species is similar in general aspect to *F. calimana* C. M. Taylor and *F. lutescens* Standley; however, both of these last two species have leaves with the venation not or indistinctly visible on the lower surface, corollas with the lobes 15–20 mm long and the tubes shorter (8–9 mm long), and typical fruits of *Faramea* that are smaller (ca. 8 × 15–16 mm) and have a thin-textured pericarp. This new species has been previously confused with *F. calophylla* Standley, which grows in the same region; however, *F. calophylla* has leaves that are shiny on both surfaces, slender shorter corollas with the tubes ca. 7 mm long and the lobes ca. 4 mm long, and typical fruits of *Faramea* (ca. 10 × 15 mm with a thin-textured pericarp). The only specimen of the type collection located as deposited in Colombia is reportedly incomplete and was made from a branch that was damaged by insects (P. Silverstone-Sopkin, pers. comm.). Thus, although preferably the holotype specimen should be that deposited in the country of origin of the species, in this exceptional case the complete specimen in better condition at MO is here chosen as the holotype.

Paratypes. COLOMBIA. **Valle del Cauca**: costa del Pacífico, Río Naya, Puerto Merizalde, *J. Cuatrecasas 14105* (F); Reserva Nat. del Río Escalarete, *Devia & Cogollo, Ramirez, Kell, Gonzalez, Cruz 4331, 4363* (MO, TULV); Bajo Calima region betw. Buenaventura & Río Calima, Cartón de Colombia/Pulpalel concession, *M. Monsalve 623, 948, 1189* (CUVC, MO), *B. Stein, L. McDade & M. Monsalve 3238* (MO), Carr. Hans at Km 22 on main rd. to Canalete, *T. Croat 69457* (MO), along rd. betw. Buenaventura & Málaga on Carr. Hanz [sic; Hans], *T. Croat 71074* (MO), at Km 44 along rd. past Pulpapel headquarters to Bahía de Málaga, *T. Croat & J. Watt 70193* (MO), at Km 50.5, *T. Croat & J. Watt 70316* (MO), on Carr. Hanz [sic; Hans] 6.5 km N of main rd., *T. Croat 71105* (MO), San Isidro, vía Málaga, Km 51, *W. Devia & J. Prado 2605, 2656* (MO, TULV), *W. Devia 3030, 3036* (MO, TULV), Juanchaco area, at end of Gasolina rd., *D. Faber-Langendoen, M. Monsalve & E. Renteria 289* (MO), 3.4 km NW of San Isidro intersection on "Juanchaco Norte," *D. Faber-Langendoen & J. Hurtado 1580* (MO), ca. 15 km N of Buenaventura, *A. Gentry, A. Juncosa & H. Mazuera [sic] 40200, 40351* (MO), *A. Gentry & A. Juncosa 40515* (MO, NY), Dindo area, *A. Gentry, M. Monsalve & D. Wolfe 47883, 53634* (MO), rd. to Juanchaco Palmeras, *A. Gentry, M. Monsalve, W. Ladrach & H. Mazuero [sic] 48306* (MO, NY), carr. a Dindo, *M. Monsalve 1061, 1189* (CUVC, MO), Carr. Canalete, *M. Monsalve 1850, 1917, 3016* (CUVC, MO), Carr. Nac. Km 28, *M. Monsalve 3089* (CUVC, MO), Carr. Sol Naciente, *M. Monsalve 3168* (CUVC, MO).

5. Faramea ortiziana C. M. Taylor, sp. nov. TYPE: Peru. Loreto: Altura Tuta Pishco on Río Napo, 16 Sep. 1972, *T. B. Croat 20261* (holotype, MO 6053151). Figure 3A, B.

Haec species a *Faramea guianensis* (Aublet) Bremekamp inflorescentia interdum terminali atque corolla fructuque majoribus distinguitur.

Shrubs or small trees to 3.5 m tall, glabrous. *Leaves* elliptic, 11.5–22 × 3.5–8 cm, at apex acute to acuminate with tips 10–15 mm, at base acute to cuneate or somewhat obtuse, drying chartaceous, adaxially and abaxially matte; secondary veins 12 to 15 pairs, looping to interconnect in an undulating slender submarginal vein, adaxially costa prominent, secondary veins prominulous to impressed, and higher order venation plane, abaxially costa prominent, secondary veins prominulous, and higher order venation plane; petioles 3–5 mm; *stipules* united around the stem, persistent, 2–5 mm, costate on each

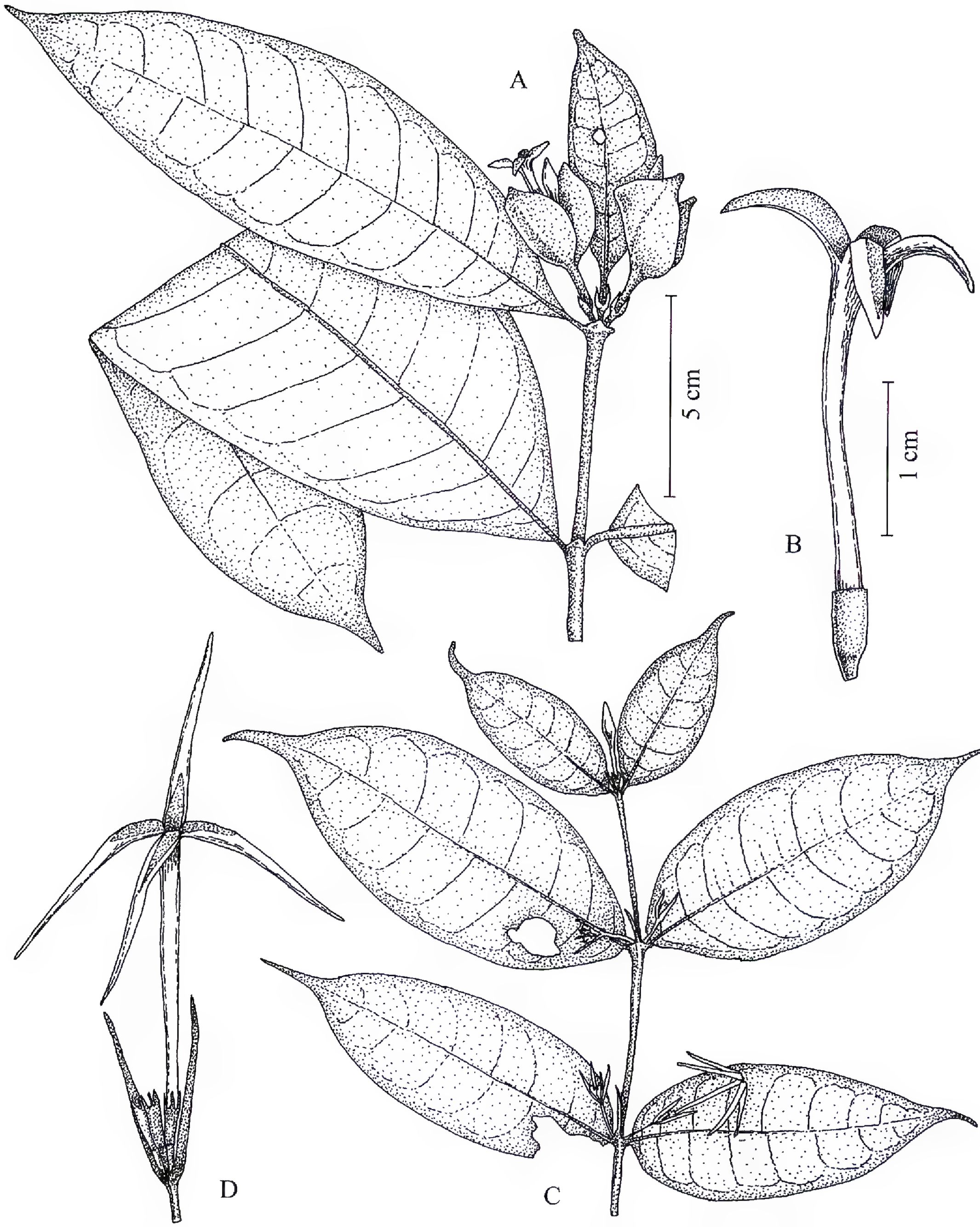

Figure 3. A, B. *Faramea ortiziana* C. M. Taylor. —A. Flowering branch. —B. Flower at anthesis. C, D. *Faramea schunkeana* C. M. Taylor. —C. Flowering branch. —D. Inflorescence with one flower at anthesis and two flowers from which corolla has fallen. A, C to 5-cm scale; B, D to 1-cm scale. A, B based on the type, *Croat 20261*; C, D based on the type, *Plowman et al. 11244*.

side, truncate, aristate with arista 10–13 mm, inserted below top of sheath, frequently broken off. *Inflorescences* axillary or terminal and fasciculate, glabrous; peduncles 1 per axil or 1 to 3 at stem apex, each bearing a single capitulum, articulated near base, basal portion 5–10 mm, at apex with a reduced stipule subtended by a pair of foliose bracts, upper portion 13–18 mm; heads ovoid, enclosed by 2 decussate pairs of involucrate bracts, outer bracts ovate, 2–2.5 × 2–3 cm, at apex shortly acuminate, at base cordate, costate and with weakly marked venation similar to that of leaves, interior bracts ovate to rhombic, ca. 10 × 8 mm, obtuse to acute. *Flowers* subsessile; hypanthium cylindrical, ca. 2 mm; calyx limb ca. 4 mm,

truncate; corolla salverform, white, glabrous externally and internally, tube ca. 23 mm, lobes narrowly triangular, 9–10 mm, acute; anthers and stigmas not seen. *Infructescences* similar to inflorescences. *Immature fruits* subglobose, 10–13 mm diam., mature color unknown; seeds smooth.

Distribution, habitat, and phenology. Wet primary forests at 95–190 m in northeastern Peru, along the Río Napo and the Río Yavarí; collected with flowers in September, with fruits in March.

Conservation assessment. This species has been collected twice in ca. 35 years, in two well-separated localities, both times as part of a general floristic survey. The second collection (*Beltrán et al. 5342*) was made as part of a preliminary botanical survey of a region targeted as particularly poorly known to science as an aid to regional preservation. The full distributional range of this species is not at all clear, and could extend into adjacent Brazil, where virtually no exploration has been done. Thus, the distribution of this species cannot be considered well known, and this species is here considered Data Deficient (DD; IUCN, 2001).

Discussion. *Faramea ortiziana* can be recognized by its one to three flowering heads borne on short peduncles and enclosed by well-developed ovate bracts (possibly future collections will have more numerous flowering heads), and its slender white corollas with the upper part of the tube and the lobes exserted above the bracts. This new species is known only from northeastern Peru, both north and south of the city of Iquitos. This elegant species is named in honor of Rosa Ortiz, a plant taxonomist and native of Iquitos who has collaborated in botanical exploration of this region. The peduncles appear to comprise two distinct internodes, with a reduced stipule and pair of leaves borne at the top of the lower portion or internode and another, larger pair of foliose bracts, the outer involucral bracts, borne at the top of the upper segment or internode. Similar morphology is seen in several other species, e.g., *F. angusta* C. M. Taylor. *Faramea ortiziana* is similar to *F. guianensis* of French Guiana; however, *F. guianensis* has stipules that taper directly into a narrowly prolonged apex (i.e., the apex is not inserted below the top of the sheath), consistently axillary inflorescences, peduncles that are not articulated, shorter corollas with the tubes ca. 8 mm long and the lobes ca. 4 mm long, and smaller ovoid fruits ca. 8 × 5 mm. *Faramea ortiziana* is also similar to *F. bracteata* Bentham of north-central Brazil; however, *F. bracteata* has subsessile leaves with rounded to cordulate bases, inflorescences with five to 12 peduncles, shorter calyx limbs 0.5–1 mm long, and shorter corollas with tubes 9–10 mm long and lobes 4–5 mm long.

Paratype. PERU. **Loreto**: prov. Mariscal Ramón Castilla, Río Yavarí, 20 km río abajo desde Angamos, Quebrada Curacinha, 5°03′S, 72°44′W, *H. Beltrán, R. Foster, N. Pitman, R. Garcia, C. Vriesendorp & M. Huite 5342* (F).

6. Faramea robusta C. M. Taylor, sp. nov. TYPE: Colombia. Chocó: Mpio. de Nuquí, correg. de Arusi, Cabo Corriente region, area of El Amargal Biological Station (INGUEDE Foundation), 5°34′N, 77°30′W, 0–80 m, 5 May 1997, *D. Tuberquia, J. Rova, C. Sundbaum & L. García 494* (holotype, S). Figure 1C, D.

Haec species a *Faramea polytriadophora* Bremekamp pedunculo 20–50 mm longo, pedicello 1.5–3 mm longo atque corollae albae tubo ca. 18 mm longo lobulis ca. 5 mm longis distinguitur.

Trees to 18 m tall, glabrous. *Leaves* elliptic to obovate, 13–30 × 3.5–12 cm, at apex acute to acuminate with tips 5–10 mm, at base acute to obtuse or rounded, drying chartaceous to subcoriaceous, adaxially shiny, abaxially matte; secondary veins 8 to 11 pairs, looping to interconnect at least weakly, often forming an undulating submarginal vein, adaxially venation plane, abaxially costa and secondary venation prominulous and higher order venation plane to prominulous; petioles 0.8–3.5 cm; *stipules* united around the stem, persistent on apical 1 to 3 nodes or often fragmenting, 1–4 mm, abaxially smooth, truncate or sometimes triangular when subtending inflorescences, aristate with arista 0.5–1 mm. *Inflorescences* terminal from a somewhat thickened node at top of vegetative stem, fasciculate, glabrous, ebracteate; peduncles 14 to 18, 20–50 mm, slender, unbranched or branched to 1 order (i.e., with 1 to 3 groups of flowers), unarticulated or occasionally with an articulation 3–5 mm above the base (i.e., in the lower 1/7–1/10); pedicels 1.5–3 mm. *Flowers* in umbelliform groups of 3 to 5; hypanthium cylindrical to turbinate, ca. 0.8 mm; calyx limb ca. 1 mm, truncate; corolla white, glabrous externally and internally, tube ca. 18 mm, lobes narrowly triangular, ca. 5 mm, acute; anthers ca. 5 mm, partially exserted, apiculate at apex; style ca. 5 mm, stigmas 2, linear, ca. 1.5 mm. *Infructescences* similar to inflorescences. *Fruits* oblate, 8–9 × 10–13 mm, glabrous, smooth, becoming red then purple-black; seeds smooth.

Distribution, habitat, and phenology. Wet forests at 0–100 m in northwestern Colombia; collected with flowers in May, with mature fruits in September.

Conservation assessment. This species is known from four collections essentially separated into three

localities and made over a period of ca. 8 years during general floristic explorations. Two of these localities are protected areas. Little exploration has been done in this general region, or at least few specimens have been distributed from here to North American herbaria, and the commonness of this species is unknown. Many Rubiaceae species of this region have relatively wide ranges, although they are poorly documented by specimens (pers. obs.), and this species could be widely distributed. Thus, this species is here considered Least Concern (LC; IUCN, 2001).

Discussion. *Faramea robusta* is notable for its relatively large size, with specimen data noting a height of 4.5–18 m tall, its rather large firm-textured leaves, and its unusual inflorescences composed of a vigorous terminal spray of numerous fasciculate peduncles, each bearing several flowers. The specific epithet refers to the vigorous size of the plants, as well as to the vigorous fieldwork (in extensive travel into areas of difficult access, collection of significant numbers of significant specimens, and work with various collaborators from various institutions) of Dino Tuberquia, the collector of the type specimen. Unfortunately, some of the flowers on the type specimen appear to be galled, with enlarged ovaries and malformed corollas. This new species is similar to *F. polytriadophora* of Guyana, which has a similar inflorescence arrangement. However, *F. polytriadophora* is well separated geographically from this new species and has generally shorter peduncles (13–20 mm long), longer pedicels (7–10 mm long), and corollas with the shorter tubes lavender-pink and ca. 15 mm long and the longer white lobes ca. 8 mm long. This new species is also similar to *F. colombiana*, described herein; *F. colombiana* has longer calyx limbs (3–4 mm long) and shorter corolla tubes (10–11 mm long). This new species is also similar vegetatively and in many reproductive features to *F. torquata* Mueller Argoviensis, found from Colombia to Bolivia; *F. torquata* has an inflorescence composed of only one to three peduncles that usually bear a characteristic articulation in the lower 1/4–1/3 and shorter corolla tubes 9–10 mm long.

Paratypes. COLOMBIA. **Chocó**: mpio. Nuquí, correg. Termales, coastal zone betw. Quebrada Piedra Piedra & Río Terco, *P. Acevedo-Rodriguez, R. Callejas & S. P. Churchill 6908* (MO, US); Parque Nac. de Utría, Isla Playa Blanca, al NO de la Ensenada de Utría, terrenos del Sr. Sálomon Caisamo, *F. García C. & E. Agualimpia 301* (MO); Parque Nac. de Utría, playa al SE de las bocas del Río San Pichí, *F. García C. & E. Agualimpia 463* (MO).

7. **Faramea schunkeana** C. M. Taylor, sp. nov. TYPE: Peru. Huánuco: prov. Leoncio Prado, distr. Rupa Rupa, Tingo María, limestone hills opposite airport, 9°18′S, 75°59′W, 700–780 m, 9 Dec. 1981, *T. Plowman, M. Ramírez R. & P. M. Rury 11244* (holotype, F 1898603; isotype, MO 3615598). Figure 3C, D.

Haec species a *Faramea morilloi* Steyermark foliis ad basin obtusis usque rotundatis vel cordulatis, corolla majore atque seminibus laevibus distinguitur.

Shrubs to 2 m tall, glabrous. *Leaves* elliptic to elliptic-oblong or broadly elliptic, 4.5–13.5 × 2–7 cm, at apex rounded then abruptly acuminate with tips 1–18 mm, at base obtuse to usually rounded or cordulate, drying chartaceous, adaxially shiny, abaxially matte and drying paler to yellowed; secondary veins 7 to 10 pairs, looping weakly to interconnect in a slender submarginal vein, adaxially costa prominent and remaining venation plane to prominulous, abaxially costa plane to prominent and remaining venation plane to prominulous; petioles 1–3 mm; *stipules* united around stem, persistent, 0.5–2 mm, costate on each side, truncate, aristate with arista 6–12 mm, inserted at or shortly below top of sheath. *Inflorescences* supra-axillary and terminal, glabrous; peduncles 1 per axil or 1 at stem apex, 0.5–10 mm, not articulated, each bearing a single capitulum, at apex with a reduced stipule fused with 1 or 2 pairs of bracts, these narrowly triangular to lanceolate, 8–20 mm, acute; capitulum enclosed within outmost (i.e., largest) bracts. *Flowers* 1 to 3 per head, subsessile, subtended by 2 to 5 aciculate bracts, 2–4 mm; hypanthium cylindrical, 1–1.5 mm; calyx limb with tube 2.5–3 mm, truncate to concave between lobes, lobes linear, 1–2 mm; corolla salverform, white, glabrous externally and internally, tube ca. 23 mm, lobes narrowly triangular, ca. 17 mm, acuminate; anthers and stigmas not seen. *Infructescences* with peduncles elongating, up to 52 mm. *Fruits* subglobose, ca. 14 mm diam., black; seeds smooth.

Distribution, habitat, and phenology. Wet forests at 700–880 m in central Peru, at least sometimes on limestone substrate; collected with flowers in March and December, with fruits in August.

Conservation assessment. This species is known from three collections made at two widely separated localities 25–30 years ago during general floristic explorations. These sites are presumably now degraded because that is the condition of most areas accessible to collectors 30 years ago, although the state of vegetation on unusual substrates such as this is not known. The area where this new species occurs is not well known botanically overall (Schulman et al., 2007). The distribution range of this species cannot be well estimated, and this species is here considered Data Deficient (DD; IUCN, 2001).

Discussion. *Faramea robusta* can be recognized by its subsessile or very shortly petiolate leaves with obtuse to usually rounded or cordulate bases, its terminal and supra-axillary capitate inflorescences surrounded by narrow bracts and a reduced stipule, and its peduncles that apparently elongate markedly as the flowers and fruits develop. This species is only known from three collections from central Peru; two of them are from the same site, which lies on limestone substrates. This notable species is named in honor of José Schunke V., a noted and very productive Peruvian botanist. The peduncles terminate in a reduced stipule and several rather leaf-like though reduced bracts, and the flowers are surrounded by additional bracts that resemble the aristas of the stipules. Similar morphology is sometimes seen in some other species, e.g., *F. angusta*. *Faramea schunkeana* is similar to *F. morilloi* of southern Venezuela and Guyana; however, *F. morilloi* has leaves that are acute at the base, smaller corollas with the tubes ca. 17 mm long and the lobes 7–10 mm long, and seeds with eight longitudinal ridges. *Faramea schunkeana* is also similar to *F. angusta* of Ecuador; however, *F. angusta* has narrowly elliptic leaves 0.5–3.5 cm wide with acute bases, stipule sheaths 1.5–6 mm long, and smaller blue corollas with the tubes 8–9 mm long and the lobes 9–9.5 mm long.

Paratypes. PERU. **Huánuco**: prov. Leoncio Prado, distr. Rupa Rupa, al O de Tingo María, cerro frente al aeropuerto, *J. Schunke V. 10423* (MO). **San Martín**: prov. Cáceres, Madre Mía, *J. Boeke & M. Ramírez 1316* (NY).

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Chamaegastrodia nanlingensis (Orchidaceae), a New Species from Guangdong, China

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ABSTRACT. *Chamaegastrodia nanlingensis* H. Z. Tian & F. W. Xing, a new species from Ruyuan county, in northern Guangdong, South China, is described and illustrated. It is similar to *C. poilanei* (Gagnepain) Seidenfaden & A. N. Rao, from which it differs in having smaller flowers, a yellow lip without a pair of elongate introrse lobules at the epichile lobe, a slightly erose margin, and much smaller dorsal sepals and petals.

Key words: *Chamaegastrodia*, China, Cranichideae, Goodyerinae, IUCN Red List, Orchidaceae.

The genus *Chamaegastrodia* Makino & F. Maekawa belongs to tribe Cranichideae, subtribe Goodyerinae, Orchidaceae (Dressler, 1993). There are five species recorded worldwide, viz. *C. asraoa* (J. Joseph & Abbareddy) Seidenfaden & A. N. Rao, *C. inverta* (W. W. Smith) Seidenfaden, *C. poilanei* (Gagnepain) Seidenfaden & A. N. Rao, *C. shikokiana* Makino & Maekawa, and *C. vaginata* (Hooker f.) Seidenfaden (Seidenfaden, 1994). They range across the Asian mainland from India (Meghalaya) eastward to Japan, associated with 30°N and southward to Vietnam and northern Thailand (Seidenfaden, 1994: fig. 7). There are four species recorded from China, which are mainly distributed in Hubei, Yunnan, Sichuan, and northeastern Tibet (Lang, 1999).

During 2004 fieldwork in Nanling National Nature Reserve in northern Guangdong, China, a new species of the genus *Chamaegastrodia* was found. The genus is also newly recorded for Guangdong province.

Chamaegastrodia nanlingensis H. Z. Tian & F. W. Xing, sp. nov. TYPE: China. Guangdong: Xiaohuangshan, Ruyuan, Nanling Natl. Nature Res., 24°55′N 113°01′E, 1320 m, 7 Aug. 2004, *H. Z. Tian & C. H. Li 67* (holotype, IBSC). Figure 1.

Species *Chamaegastrodiae poilanei* (Gagnepain) Seidenfaden & A. N. Rao proxime affinis, sed floribus minoribus, sepalis dorsalibus 3.8–4.1 × 1.8–2 mm; petalis 4.5–4.8 × 1–1.3 mm; labiis flavis, 11.2–12.2 mm longis, Y-formibus, ad marginem leviter erosis, ad apicem 5.8–7 mm latis, lobis in lobo epichilii introrsis elongatis absentibus differt.

Plants leafless; rhizome slender, 25 cm, 2 mm diam., fleshy, horizontal, hazel in color, translucent; roots fleshy, short, thickset, 3.5 cm, 5 mm diam., dark and slender at the base, white and thickened at the apex, coralloid, with brick-red scales and scattered warts, producing sparse short branches; branches 1 cm, 5 mm diam., white. Stems ca. 14 cm, 4 mm diam., erect, light brown, covered with overlapping brick-red sheath scales from base. Scales ca. 7 to 15 per stem, membranous, decurrent at base and oblique at mouth, puberulous externally and fringed. Inflorescences lax, with 4 to 9 flowers, with a puberulous rachis, elongated during fruiting; fertile bracts maroon, ca. 8 × 3.2 mm, as long as or a little longer than the ovary, ovate to lanceolate, acuminate, erect, puberulous externally, enveloping the ovary, with one distinct vein; pedicel and ovary ca. 8 × 2 mm, fusiform, finely puberulous. Flowers non-resupinate; dorsal sepal fawn-colored, ca. 3.8–4.1 × 1.8–2 mm, ovate, acute, with a distinct midvein, puberulous externally and densely at the apex; lateral sepal fawn-colored, ca. 7–7.2 × 3.2–3.5 mm, falcate, acute, with 2 veins, one distinct and the other vein fainter, puberulous externally, densely so at apex; petals ca. 4.5–4.8 × 1–1.3 mm, falcate, acute, 1-veined; lip yellow, ca. 11.2–12.2 × 5.8–7 mm at apex, Y-shaped, margin slightly erose, saccate at base, epichile broadly 2-lobed, absent a pair of elongate introrse lobules, each lobe subquadrate, ca. 3.2–4 × 2.8–3.2 mm, outer margin running down to base of mesochile, narrower in middle and broader at base to form a sac, mesochile unequally fringed, the fringed claw ca. 5–5.4 mm; sac ca. 2–2.2 mm diam., with 2 calluses, one on each side of the sac; callus dark, gibbous,

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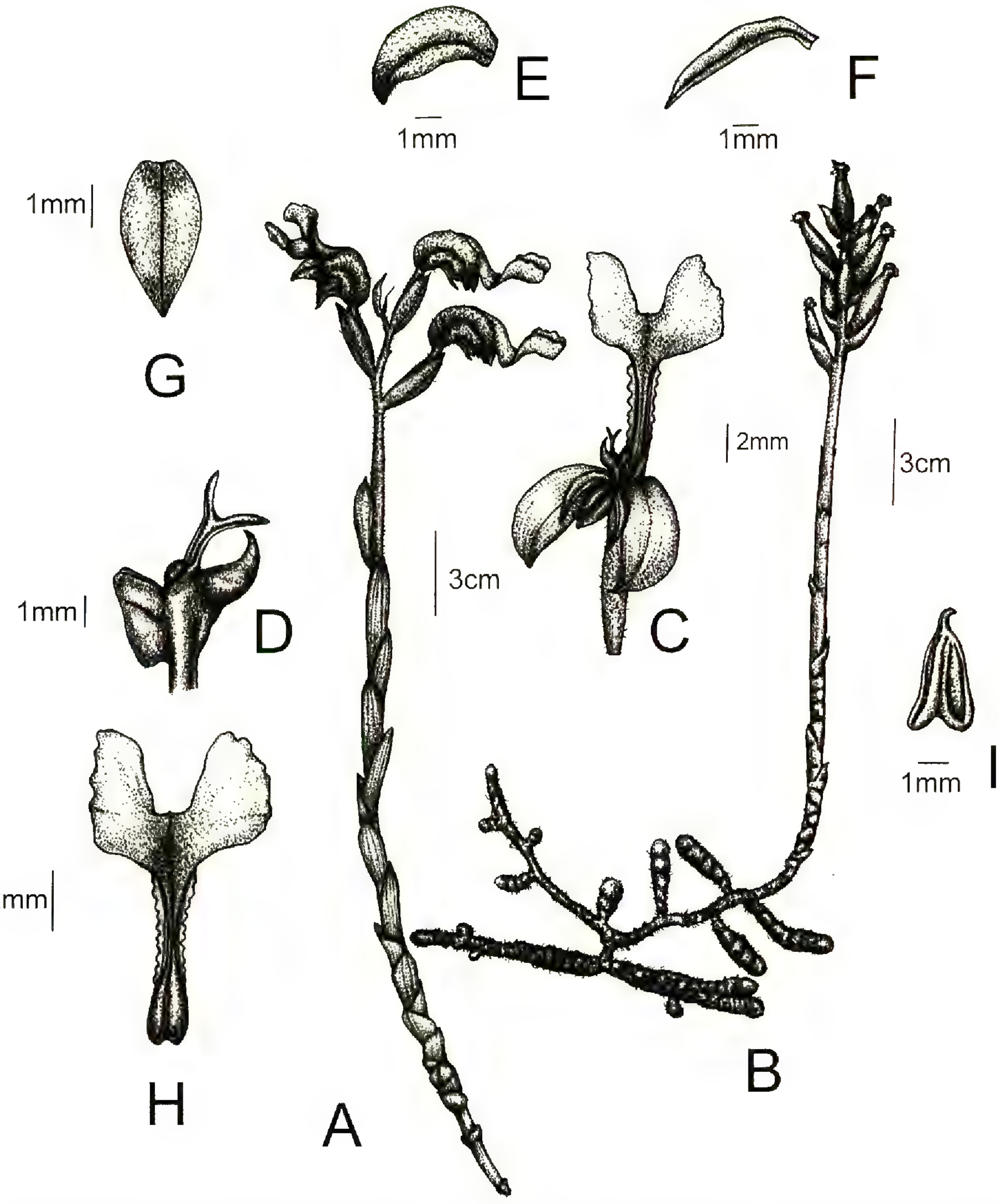

Figure 1. *Chamaegastrodia nanlingensis* H. Z. Tian & F. W. Xing. —A. Habit with flowers. —B. Habit with fruits. —C. Flower. —D. Column, lateral view. —E. Lateral sepal. —F. Petal. —G. Dorsal sepal. —H. Lip. —I. Anther, inside view. A, C–I drawn from the holotype *H. Z. Tian & C. H. Li 67* (IBSC); B drawn from the paratype *H. Z. Tian & A. Q. Hu 358* (PE).

sessile, subglobose; column ca. 2.8 × 0.6 mm, short, at front with 2 processes; stigmatic processes 2, flat, oblong, fleshy, attached to the column vertically; anther ca. 2 × 1 mm, lanceolate, acuminate, cordate at base; rostellum forked, erect, ca. 1.1 mm, as long as the anther cap peak. Capsule ellipsoid, ca. 11 × 5 mm, 4-ridged, splitting, brick-red when mature, with persistent wizened flower.

Distribution and habitat. The natural habitat of this species was in humus-rich soil, in evergreen broad-leaved forests; it was collected from 1300–1570 m elevation. Species found with *Chamaegastrodia nanlingensis* include *Castanopsis eyrei* (Champion ex Bentham) Tutcher, *Dicranopteris dichotoma* (Thunberg) Bernhardi, *Parakmeria lotungensis* (G. L. Chun & C. H. Tsoong) Y. W. Law, and *Smilax china* L. Plants of the new species were also found in Shikengkong and Jigongkeng, which are also within the Nanling National Nature Reserve. The plants are so inconspicuously leafless that they are easily overlooked. Nanling National Nature Reserve is located on the south slopes of the Nanling mountain range, which has a typically subtropical flora, lying between 24°38′N and 25°00′N (Chen et al., 1999). Other species of *Chamaegastrodia* were discovered in the same distributional area.

IUCN Red List category. *Chamaegastrodia nanlingensis* has been collected from Ruyuan county,

Table 1. Morphological comparison between *Chamaegastrodia nanlingensis* and *C. poilanei*.

Character	*C. nanlingensis*	*C. poilanei*
Dorsal sepal (mm)	3.8–4.1 × 1.8–2	7 × 4
Petals (mm)	4.5–4.8 × 1–1.3	7 × 1.5
Lip color	yellow	orange-yellow
Lip (mm)	11.2–12.2 × 5.8–7	16 × 13
Epichile	Y-shaped; absence of a pair of elongate introrse lobules at the epichile lobes	Y-shaped; with a pair of elongate introrse lobules at the epichile lobes
Mesochile length (mm)	claw ca. 5–5.4	claw ca. 6–8

from only four locations in Guangdong province, and one location in Hunan province, China. It appears to be endemic to the Nanling mountain range. Its population size is estimated to number fewer than 250 mature individuals. According to IUCN Red List criteria (IUCN, 2001), the new species should be treated as Endangered (EN).

Phenology. Flowering in early August and lasting for about one week; fruiting from mid-August to October.

Relationships. Chamaegastrodia nanlingensis is similar to *C. poilanei* but differs in the relative sizes of the lip, dorsal sepals, and petals, and in the absence of a pair of elongate introrse lobules at the epichile lobe, which has just an erose margin. More detailed morphological comparisons are given in Table 1.

Paratypes. CHINA. **Guangdong:** Ruyuan, Xiaohuangshan, Nanling Natl. Nature Res., 21 Aug. 2005, *H. Z. Tian & A. Q. Hu 358* (PE); Shikengkong, Nanling Natl. Nature Res., 24 Oct. 2004, *H. Z. Tian & F. G. Wang 230* (IBSC); Xiaohuangshan, Nanling Natl. Nature Res., 10 Aug. 2006, *H. Z. Tian & Y. K. Wu 556* (IBK, IBSC); Jigongkeng, Nanling Natl. Nature Res., 12 Aug. 2006, *H. Z. Tian & S. Y. Liu 570* (IBSC). **Hunan:** Lanshan, Bantang Nature Reserve, 9 Aug. 2007, *X. L. Yu 070136* (CSFI).

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Two New Species of *Hedyotis* (Rubiaceae: Hedyotideae) from Hainan, China

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ABSTRACT. *Hedyotis cheniana* R. J. Wang and *H. wuzhishanensis* R. J. Wang, from Hainan Province, China, are described as new. *Hedyotis cheniana* is similar to *H. terminaliflora* Merrill & Chun in having a terminal condensed inflorescence, but differs in having elliptic to ovate, or sometimes circular leaves with rounded or truncated leaf bases and distinct petioles, narrowly triangular stipules with a lacerate margin, heterostylous flowers, and short calyx tubes. *Hedyotis wuzhishanensis* is similar to *H. paridifolia* Dunn in having two pairs of leaves that are closely adjacent to the terminal inflorescence, but it can be distinguished by its covering of sparse to dense hairs on all vegetative organs, four to five pairs of secondary veins, and distinct petioles. These two new species belong to *Hedyotis* sect. *Diplophragma* Wight & Arnott based on the dehiscent pattern of their mature capsules.

Key words: China, *Hedyotis*, sect. *Diplophragma*, IUCN Red List, Rubiaceae.

The genus *Hedyotis* L. (s.l.) occurs throughout the tropical and warm subtropical regions of the world. Under a broad generic circumscription, approximately 515 species from Asia and the Americas are included in this large heterogeneous genus (Terrell & Robinson, 2003; Dutta & Deb, 2004). The inflorescence structure of species belonging to this genus varies from paniculate, corymbose, or umbellate to condensed capitate cymes, with usually 4-merous flowers. Capsules range from globose to ovoid or ellipsoid, dehiscing septicidally, loculicidally, or obscurely, or indehiscent. Seeds in *Hedyotis* are minute, angled, and embedded in the central placenta.

Hedyotis, a genus of subfamily Rubioideae (Bremer, 1996), was traditionally placed in the tribe Hedyotideae Chamisso & Schlechtendal ex DC. (Verdcourt, 1958; Bremekamp, 1966; Robbrecht, 1988). Although recent molecular studies (Bremer, 1996; Bremer & Manen, 2000) showed that *Hedyotis* was in the tribe Spermacoceae Berchtold & Presl, here, in the more traditional manner, I treat Hedyotideae as a separate tribe based on the basic differences in the seed and fruit morphology of the two tribes (Terrell et al., 2005). Moreover, there has been confusion over the delimitation of *Hedyotis* L. (s. str.) and *Oldenlandia* L. ever since the two genera were first proposed by Linnaeus in 1753. Lamarck (1791) first combined the two genera and accepted *Hedyotis* as the name of the combined genus, but this generic circumscription was not accepted by other workers, e.g., Bremekamp (1952), Verdcourt (1976), Terrell and Robinson (2003), and Terrell et al. (2005). Paraphyletic (Bremer, 1996; Bremer & Manen, 2000) or polyphyletic (Andersson & Rova, 1999; Andersson et al., 2002) relationships of *Hedyotis* and *Oldenlandia* in molecular studies imply that the name *Hedyotis* has been applied to several related groups (Terrell & Robinson, 2003), and an objective delimitation of this complicated group is still uncertain. The lack of comprehensive taxonomic and phylogenetic study on Chinese *Hedyotis* species suggests that a broad concept of *Hedyotis* be maintained, and two new species are described here.

1. Hedyotis cheniana R. J. Wang, sp. nov. TYPE: China. Hainan: Maoan, Mt. Jianling, mtn. area, granite, in valley, dense forest, shady places, 620–920 m, 29 Feb. 1956 (fl), *Investigating team for Hainan Vegetation of the Chinese Academy of Sciences 00797* (holotype, IBSC; isotype, KUN). Figure 1.

Species nova *Hedyotidi terminaliflorae* Merrill & Chun similis, a qua foliis ellipticis, ovatis vel interdum circularibus ad basem rotundis vel truncatis, et distincte petiolatis, stipulis angusto-triangularibus laceratis, floribus heterostylis, tubis calycium brevibus (1–2 mm longis) differt.

Undershrubs, ca. 0.5 m tall, erect, glabrous, branching above; stems terete but a little grooved in young branches. Leaves 1.7–3.8(–5) × 1.6–2.5 cm, elliptic to ovate, sometimes circular, obtuse, acute or mucronate at apex, rounded or truncate at base, coriaceous, glabrous; secondary veins in 3 or 4 pairs, obscure adaxially, prominent abaxially; petiole slender, 2.5–5(–9.7) mm; stipules 2–3.5 × ca. 1.8 mm, narrowly triangular, pinnately lacerate, coriaceous, glabrous. Inflorescence terminal, subcapitate, with 10

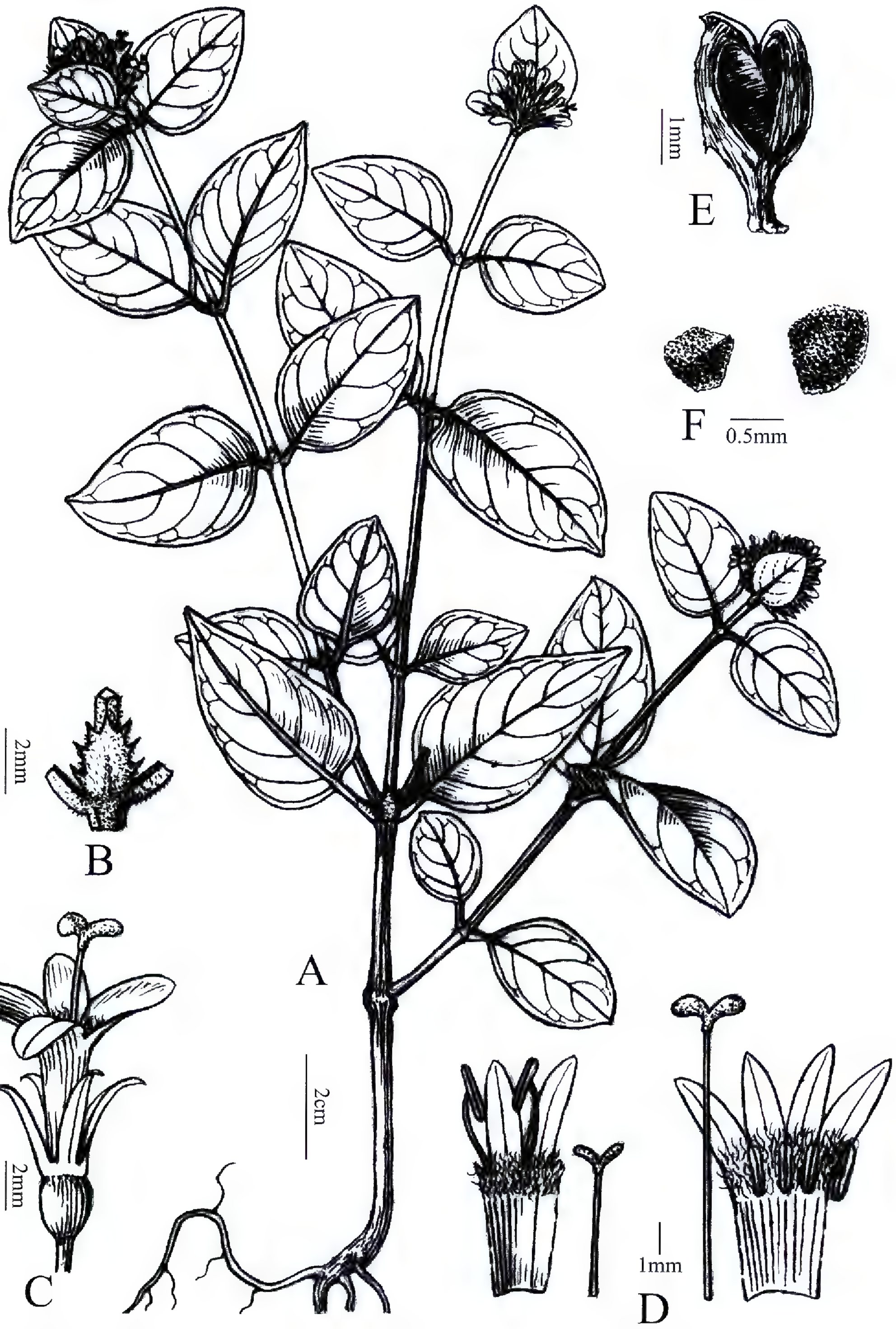

Figure 1. *Hedyotis cheniana* R. J. Wang. —A. Habit. —B. Stipule. —C. Long-styled flower. —D. Corolla and style (left: short-styled, right: long-styled). —E. Capsule coccus. —F. Seeds (left: adaxial view, right: abaxial view). Drawn from the holotype, *Investigating team for Hainan Vegetation of the Chinese Academy of Sciences 00797* (IBSC).

to 30 flowers per cyme, 1–2 cm diam., peduncles short, 2–3 mm. Flowers 7.5–9 mm, heterostylous, pedicels ca. 2 mm; calyx tube ca. 1–2 mm, lobes 4, ca. 4 mm, lanceolate, apex acuminate; corolla cylindric, white, tube ca. 5 mm, pubescent at throat, lobes 4, ca. 2 mm, oblong to lanceolate; stamens 4, adnate to the pubescent throat of corolla tube, anthers 1–1.5 mm, oblong-linear; stigma bilobed, papillate;

long-styled flowers, with stamens included, filaments ca. 1 mm, styles ca. 10 mm, exserted; short-styled flowers, with stamens exserted, filaments ca. 2 mm, styles ca. 5.5 mm, included. Capsule globose, ca. 2 mm diam., with persistent calyx limbs, ca. 4 mm, glabrous, dehiscing partially loculicidal at apex and then completely septicidal; seeds 6 to 10, angular, ca. 0.8 mm, testa reticulate, black.

Distribution and ecology. All known collections occur in Hainan Province, China. The plants were growing in dense forest, on summits, or on slopes or valleys, in scattered, rich soil or granite sites, at altitudes from 620–960 m.

IUCN Red List category. *Hedyotis cheniana* is mainly distributed in central Hainan Island and can grow in various habitats. Although no herbarium specimen of this species has been collected after 1959, I assess it as Least Concern (LC) according to IUCN Red list criteria (IUCN, 2001), because of its extensive distribution and the protected habitat in the areas in which it was collected.

Phenology. Collected in flower from January to February and in fruit from June to November.

Etymology. *Hedyotis cheniana* is named in honor of the Chinese collector Shao-Qing Chen (IBSC).

Relationships. The new species belongs to *Hedyotis* sect. *Diplophragma* Wight & Arnott because its globose capsule dehisces loculicidally initially at the apex, then septicidally below. Its condensed subcapitate terminal inflorescences resemble those of *H. terminaliflora*, but the new species can be distinguished by its elliptic to ovate leaves with a rounded to truncate leaf base and distinct petiole (vs. lanceolate to oblong-lanceolate leaves with an acute to subacute leaf base and 1–2 mm petiole in *H. terminaliflora*), the lacerate, narrowly triangular stipule (vs. integrated and ovate stipule in *H. terminaliflora*), the heterostylous flowers, and short calyx tubes (vs. 3 mm long in *H. terminaliflora*).

Paratypes. CHINA. **Hainan:** Mt. Jianling, 29 Feb. 1956, *Investigating team for Hainan Vegetation of the Chinese Academy of Sciences 00795* (IBSC, KUN); Mt. Jianling, 9 Nov. 1959, *Sino-Germany collection team 1964* (IBSC, MO); Baoting, 21 Feb. 1957, *L. Tang* (*Liang Deng*) *3782* (IBSC, MO); Ledong Co., Mt. Chang-E-Ling, 25 June 1936, *Xin-Qi Liu 27267* (IBSC, KUN); Lingshui Co., on rd. from Tongjia to Wenhua, 13 Jan. 1934, *Xiang-Ri Liang 64656* (IBSC).

2. Hedyotis wuzhishanensis R. J. Wang, sp. nov. TYPE: China. Hainan: Ding'an Co., Mt. Wuzhishan (Mt. Five-finger), riverside, 19 Dec. 1933 (fl, fr), *Zhi Huang 35636* (holotype, IBSC; isotype, MO). Figure 2.

Species nova *Hedyotidi paridiflorae* Dunn similis, a qua caulibus, foliis, petiolis, stipulis, sepalisque pubescentibus, venis secundariis in 4 vel 5 paribus dispositis, petiolis 3.8–5.7(–10) mm longis differt.

Shrubs to subshrubs, ca. 0.5–1 m tall, erect, diffuse, pubescent; stems terete, densely pubescent on young leaflets and then gradually sparser; internodes usually 1.8–4.9(–8) cm but ca. 2 mm acropetally. Leaves (2.5–) 3.4–5.5(–6.2) × 1.4–2.8(–3.3) cm, elliptic or ovate, sparsely pubescent on both sides, with dense pubescence along the midrib and veins, acute at apex, rounded to subrounded at base, papyraceous; secondary veins in 4 to 5 pairs; petiole 3.8–5.7(–10) mm, densely pubescent; stipules ca. 2.5 mm, triangular with acuminate apex, pubescent. Inflorescence terminal or in upper leaf axils, cymes, 0.7–1.7 cm diam., subtended by 4 leaves at the 2 uppermost reduced internodes. Flowers (2)6 to 15 per inflorescence, 8.5–10 mm, sessile to subsessile; calyx tube ca. 1.8 mm, lobes 4, 2.5–3 mm, lanceolate, apex acuminate, pubescent; corolla funnelform, white, tube 5.5–6.5 mm, pubescent adaxially, lobes 4, ca. 2.5 mm, oblong to lanceolate, pubescent abaxially; stamens 4, exserted, filaments 1–2 mm, adnate to the throat of corolla tube, anthers oblong-linear, 1.5–2 mm; styles ca. 5 mm, stigma bilobed, lobes 1–2 mm, linear, papillate. Capsule ovoid, ca. 3 × 2.5 mm, appearing 4.5–7.5 mm long including persistent calyx limbs, densely pubescent, dehiscing loculicidally at the apex initially, then proceeding septicidally when mature; seeds ca. 15, angular, ca. 0.5 mm long, testa reticulate, black.

Distribution and ecology. *Hedyotis wuzhishanensis* was found on Mt. Wuzhishan and one of its branches, Mt. Limuling. The plants usually grow on mountain summits, valleys, or near rivers, in forest, at altitudes from 600–1540 m.

IUCN Red List category. *Hedyotis wuzhishanensis* is endemic to Mt. Wuzhishan. Because of the poor and limited collection in this area, the five specimens examined were collected from 1933 to 1989. However, the species can grow in various habitats and may distribute extensively on many branches of Mt. Wuzhishan, which is protected as a nature reserve. I therefore assess the status of this species as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Collected in flower and fruit from October to December.

Relationships. The new species belongs to *Hedyotis* sect. *Diplophragma* because its ovoid capsules

Figure 2. *Hedyotis wuzhishanensis* R. J. Wang. —A. Habit. —B. Stipule. —C. Flower (left: adaxial view, right: flower with calyx). —D. Capsule coccus. —E. Seeds (left: adaxial view, right: lateral view). Drawn from the holotype, *Zhi Huang 35636* (IBSC).

dehisce loculicidally first at the apex and then septicidally as the capsules develop. It is close to *H. paridifolia* in having the inflorescences terminal or in upper leaf axils, which are partly hidden within the subtended leaf bases, but the new species can be easily distinguished by having an obvious indument on the stem, leaf lamina and petiole, stipules, and sepals (vs. glabrous in *H. paridifolia*), four to five pairs

of secondary veins (vs. five to seven pairs in *H. paridifolia*), and petioles 3.8–5.7(–10) mm long (vs. 0–0.5 mm in *H. paridifolia*).

Hedyotis paridifolia, which was wrongly assigned to *Hedyotis* sect. *Hedyotis* by Ko (1999), should belong to *Hedyotis* sect. *Diplophragma*, because my careful examination of a specimen of *H. paridifolia* (*Xing-Ri Liang 63279*, IBSC) showed that its mature capsules dehisced septicidally, rather than indehiscent capsules. Therefore *H. paridifolia* was used to compare with *H. wuzhishanensis* in the diagnosis here.

Paratypes. CHINA. **Hainan:** Mt. Wuzhishan, 26 Oct. 1989, *Guo-Ai Fu 6736* (IBSC), 17 Dec. 1933, *Zhi Huang 35521* (IBSC), 7 Nov. 1954, *Hainan East Team 574* (IBSC); Mt. Limuling, 17 Oct. 1956, *Shao-Qing Chen 10662* (IBSC).

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Hypoxis bampsiana subsp. *tomentosa*, a New African Taxon of Hypoxidaceae

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ABSTRACT. A description of *Hypoxis bampsiana* Wiland (Hypoxidaceae) is extended, and a new subspecies, *H. bampsiana* subsp. *tomentosa* Wiland, is described from the Dzalanyama Forest Reserve in Malawi (also distributed from the Democratic Republic of Congo and Tanzania). It differs from *H. bampsiana* subsp. *bampsiana* in the indumentum dispersed on the whole leaf blade and in the number of leaf veins. Ranges of both subspecies are almost allopatric except at the Kundelungu Plateau in the Democratic Republic of Congo where they co-occur.

Key words: Africa, Hypoxidaceae, *Hypoxis*, IUCN Red List.

Hypoxis bampsiana Wiland was described from the Democratic Republic of Congo and Zambia (Wiland, 1997). Its known distribution was limited to the Kundelungu Plateau in the Democratic Republic of Congo and Ndola in Zambia. In a treatment of *Hypoxis* L. for the areas of Flora Zambesiaca (Malawi, Mozambique, Zambia, Zimbabwe, and Botswana), based on the study of herbarium collections, Nordal and Zimudzi (2001) regarded two specimens from Malawi as belonging to *H. bampsiana*, because of the shape of their leaves and seed testa sculpture. However, these specimens differ from typical *H. bampsiana* by having an indumentum present on both sides of the leaf lamina. A plant similar to the specimens from Zambia was also collected in Tanzania (*Bullock 2045*, K), but no scientific name was attributed to it (Nordal et al., 1985). Moreover, several plants from the Democratic Republic of Congo show congruent morphological characters with the specimens mentioned above; however, they were not included in a treatment of the genus *Hypoxis* for the latter area because of their uncertain taxonomic position (Wiland-Szymańska, 2001). Further evaluation of the herbarium materials has led me to conclude that the description of *H. bampsiana* needs to be amplified. Moreover, the morphological variation among the collections and their pattern of distribution suggests the recognition of two distinct subspecies: a typical *H. bampsiana* subsp. *bampsiana*, and the new *H. bampsiana* subsp. *tomentosa* Wiland.

Shape and size of leaves are characters often used for the identification of taxa within *Hypoxis*. Unfortunately, in many species of this genus the shape of the lamina, as well as its size, depends on the age of a plant. In such a case, further characters have to be used for determination of species. In *Hypoxis*, cataphylls—smaller outer leaves—often appear together with inflorescences. Therefore, only the inner, well-developed leaves should be taken into consideration, being much more variable in shape between species. Also, the number of veins varies between taxa of *Hypoxis* and is a useful taxonomic character.

The indumentum is one of the more important characters that distinguishes species of *Hypoxis*, and it is often used in keys (Nordal et al., 1985; Zimudzi, 1996; Wiland-Szymańska, 2001). Distribution of the leaf indumentum differs between the two subspecies described. In *H. bampsiana* subsp. *tomentosa*, the indumentum is dispersed on the whole leaf lamina, but it is absent on the ventral surface of leaves of subspecies *bampsiana*. Both taxa possess the same trichome type. It is noteworthy that in the herbarium the indumentum of *H. bampsiana* is always golden or reddish golden, whereas field notes on the herbarium sheets of subspecies *tomentosa* (*Pawek 4142*, K, MAL; *Brummit et al. 16080*, K, MAL) indicate the indumentum to be gray. Unfortunately, no description of the indumentum color of subspecies *bampsiana* was available for living plants; however, the possibility of a similar change in color during drying should be considered.

Field observations suggest that tuber color should be taken into consideration as a useful morphological character. The color of the tuber tissue of subspecies *tomentosa* has been described as white (*Pawek 4142*) and looks to be so on most of the other herbarium sheets. This is a character shared with *Hypoxis goetzei* Harms, but it needs further evaluation in the field. Therefore, all collectors are encouraged to collect specimens of Hypoxidaceae with tubers and to add a description of their flesh color (white, yellow, or

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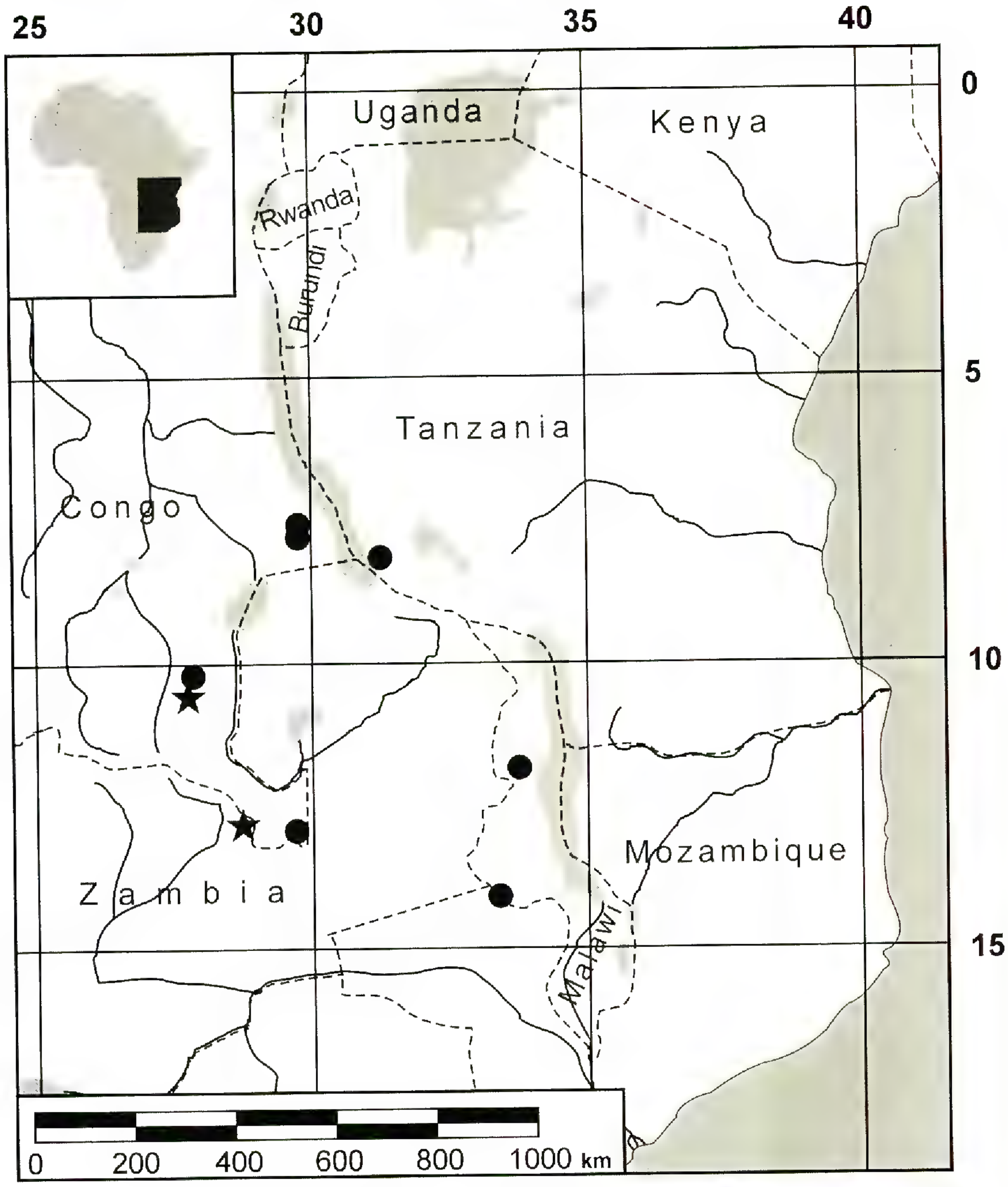

Figure 1. Distribution of *Hypoxis bampsiana*.

orange) seen just after cutting. When exposed to air, it always changes rapidly to brown, sometimes becoming bluish, and the color does not persist in the herbarium or pickled plant material.

The geographic ranges of both subspecies are almost allopatric (Fig. 1). Subspecies *bampsiana* occurs in the western part of a range of *Hypoxis bampsiana*, where it is endemic to the Upper Katanga and the Copperbelt Province in Zambia. Subspecies *tomentosa* is much more widespread, reaching as far east as Malawi and Tanzania. Both subspecies are present on the Kundelungu Plateau, but a lack of precise collection sites makes it impossible to determine whether they are sympatric or not.

A detailed description of both subspecies will hopefully help to avoid future incorrect determinations of *Hypoxis bampsiana* subsp. *tomentosa* as a different species. So far, plant materials of this taxon have been determined in various herbaria as the Central and East African *H. goetzei* or the South African *H. multiceps* Buchinger, and finally as *H. bampsiana*. These three species indeed look similar to each other in the herbarium due to their large elliptical leaves that are abruptly acuminate and often hooked at the apex. They are covered with tufted trichomes. However, they do differ in several other characters (see Table 1).

Morphological and biometric studies were conducted on 19 specimens from the following herbaria: BR, K, POZG. Flowers from herbarium specimens were boiled in water or softened with Pohl's softening agent (Pohl, 1965) for morphological analysis under a dissecting microscope. Leaf veins were counted under a light microscope. Trichomes were taken from boiled

Table 1. Character differences between four closely related taxa of *Hypoxis* with elliptical leaves. (Data with * after Pooley, 1998 and Heideman, 1987.)

Character	*H. bampsiana* subsp. *bampsiana*	*H. bampsiana* subsp. *tomentosa*	*H. goetzei*	*H. multiceps*
Tuber flesh color	white	white	white	yellow
Location of indumentum on a leaf blade	abaxial	adaxial and abaxial	abaxial	adaxial and abaxial
Trichome color of living plants	?	gray	brownish	golden or grayish
Trichome color of dried plants	golden or reddish golden	golden or reddish golden	brownish	golden
Flowering	synanthous	synanthous	hysteranthous	hysteranthous*
Flowering sequence	acropetalous	acropetalous	basipetalous	acropetalous
No. of flowers	6 to 14	4 to 9	4 to 14	1 to 4*
Seed color	brown and dull	brown and dull	brown and dull	black and glossy

scapes and leaves, and a light microscope was used for their examination and drawing. Freeze-dried seeds were examined using scanning electron microscopy after coating with gold. Data on ecology and distribution were taken from the herbarium labels of specimens.

1. Hypoxis bampsiana Wiland, Bull. Jard. Bot. Natl. Belg. 66: 207. 1997. TYPE: Democratic Republic of Congo. Shaba [Katanga]: "Plateau des Kundelungu, au bord de la riviere Lofoi," 1500 m, Oct. 1969, *S. Lisowski, F. Malaisse & J. -J. Symoens 7653* (holotype, POZG). Figure 1.

Perennial herb, to 45 cm; tuber ovoid, 5.5–6 × 2.8–6 cm (when dry), white inside, bearing membranous and fibrous remains of old leaves, growing to 8.5 cm; roots thick. *Outer leaves* 3 to 7, sheathing at base, thick, ovate, cuspidate, keeled and reflexed, (1.3–)3.5–20 × (1–)2–5 cm, tomentose on both faces or only the abaxial, nervation parallel, composed of 18 to 105 veins of different size; *inner leaves* (3)5 to 7, thick, ovate or lanceolate, cuspidate, slightly keeled, erect or slightly reflexed, (12–)13.5–46(–56) cm × (8–)14–70(–76) mm, tomentose bifacially or only abaxially, basally glabrous; trichomes tufted, 9- to 13-branched, to 1.6 mm, golden or reddish golden after drying, rather gray in the field, trichomes longer on blade edges and midrib; older leaves less hairy; nervation parallel, composed of 17 to 191 veins of different size. *Scapes* 4 to 9, 11–30 cm × 2–4 mm, compressed, short winged and ciliate in the basal part, wider and tomentose in the apical part above 1/3–1/2 of their length with tufted trichomes to 3.5 mm. *Inflorescences* 4- to 14-flowered, racemose; bracts subulate, acute, keeled, 0.9–2.5 cm × 1.5–4 mm, at the lowest, oldest flowers veined with 3 or 5 veins, with lamina abaxially covered with tufted trichomes except edges or pubescent only on midrib and veins; pedicels 3–23 mm, tomentose. *Perigone* composed of 6 tepals, yellow; outer tepals oblong or ovate, acute, slightly keeled, 13–15 × 5–6 mm, pubescent beneath, with a 1-mm-long clavate appendage under apex, nervation composed of 7 to 14 rather regular veins; inner tepals ovate, obtuse or cuspidate, 12–15 × 7–8 mm, veined with 5 to 11 irregular veins, pubescent along the midrib beneath to 1/3–1/2 of its length; *stamens* 6, biseriate, equal, 6–8 mm; filaments subulate, 2.5–5 mm; anthers linear, fused or ± emarginate at apex, prominently sagittate at base, 4.5–7 mm; *ovary* obconical, 4–10 × 3–5 mm, pubescent; style trigonous, 1–3 mm, stigma 2 mm, obtuse, solid or free-lobed. *Capsule* obconical or turbinate, circumscissile, 4–10 × 4–8 mm, surmounted by a persistent perigone, pubescent, with numerous seeds; *seeds* ovoidal or spherical, brown, dull, 1–1.5 mm, with a prominent nipple-shaped appendage at apex, covered with thick cuticle; testa bristly with pointed pyramidal projections, winged with cuticle.

1a. Hypoxis bampsiana Wiland subsp. **bampsiana.** Figure 1.

Tuber ca. 5.5 × 4.5–6 cm. *Outer leaves* 4 to 7, (1.3–)5–18 × (1–)3–5 cm; lamina tomentose abaxially, glabrous adaxially, nervation of 65 to 105 veins; inner leaves 6 or 7, (12–)17–45(–56) × 30–70(–76) mm; lamina tomentose abaxially, glabrous adaxially, nervation of 95 to 191 veins. *Scapes* 6 to 9, 14.5–30 cm × (2–)3–4 mm. *Inflorescences* 6- to 14-flowered; bracts 1–2 cm × 1.5–4 mm, the lowest 5-veined; pedicels 4–23 mm; *outer tepals* oblong, 14–15 × 5.5–6 mm, 9- to 14-veined; *inner tepals* wide-ovate, obtuse, 13 mm, 11-veined; *stamens* 8 mm; filaments 5 mm; anthers 5–6 mm, emarginate at apex; *ovary* 6–10 × 3–5 mm; style 1–3 mm, stigma solid, triangular. *Capsule* turbinate, 4–10 × 4–8 mm.

Habitat. Mountain, shrub, or wooded grasslands, miombo forest, in sandy soils, at altitudes from 1250–1650 m.

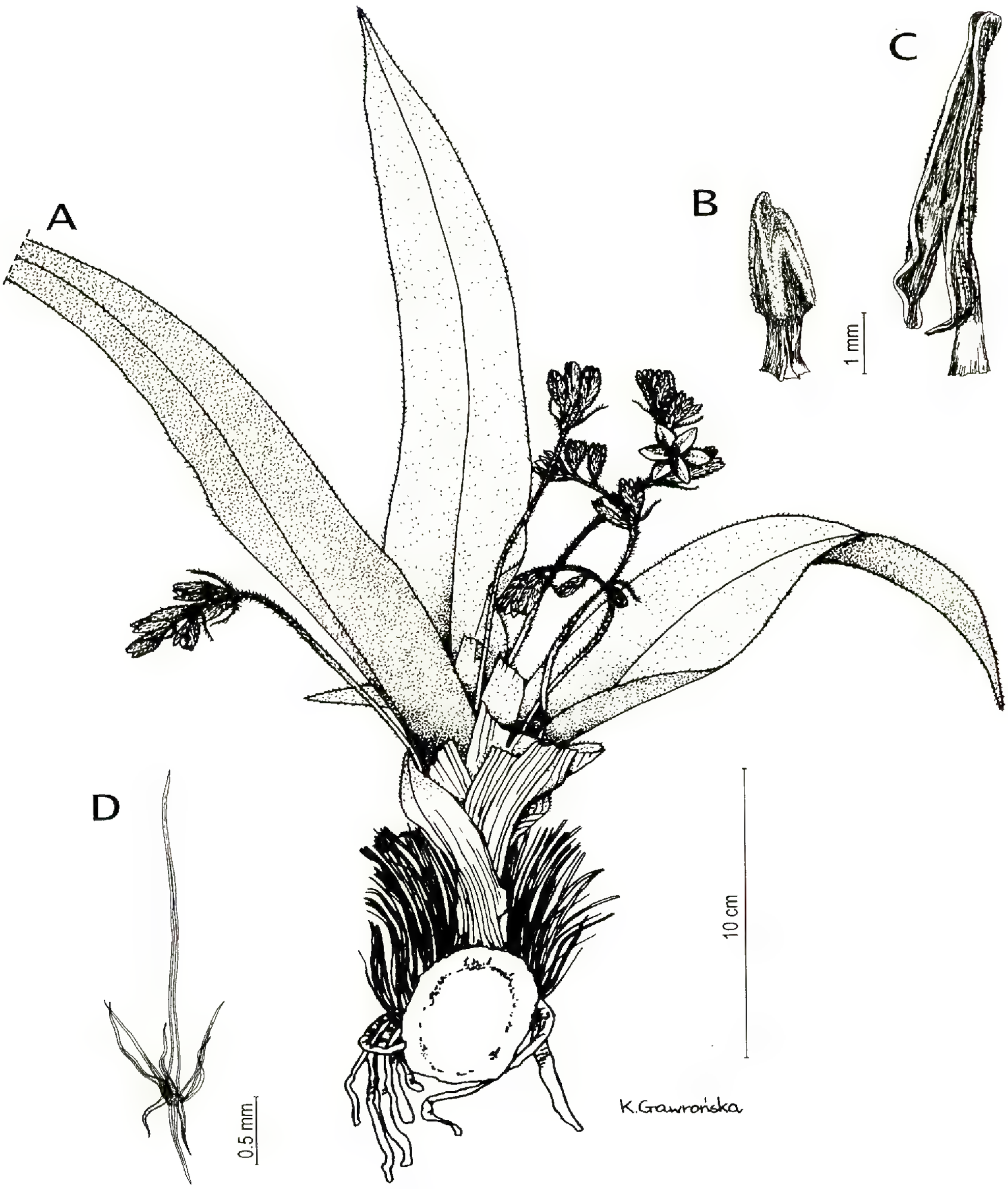

Figure 2. *Hypoxis bampsiana* subsp. *tomentosa* Wiland. —A. Habit. —B. Style with stigma. —C. Anther. —D. Trichome from the scape. A drawn from *Brummitt, Polhill & Banda 16080* (K); B, C from *Lisowski et al. 8574* (POZG); D from *Lisowski et al. 8267* (POZG).

IUCN Red List category. *Hypoxis bampsiana* subsp. *bampsiana* should be considered Endangered (EN) according to IUCN Red List criteria (IUCN, 2001). There are only two known populations, not farther than 250 km apart. Although no information on medicinal uses was available, it is possible that it might be taken as a substitute for other more useful *Hypoxis* species. An overgrazing of the grassland ecosystem, tree cutting, soil erosion, and agriculture are threats for this taxon. The last collection available for this study was made in 1971.

Specimens examined. DEMOCRATIC REPUBLIC OF CONGO. **Haut-Katanga:** Kundelungu Plateau, *Lisowski, Malaisse & Symoens 737, 7615* (POZG), betw. rivers Petite Lofoi & Kalembe, *Lisowski, Malaisse & Symoens 12947, B-7279* (POZG), riverside of Kalembe, *Lisowski, Malaisse & Symoens 12830, 12853, 12859* (POZG), riverside of Lofoi, *Lisowski, Malaisse & Symoens 7653* (POZG), near RACK camp, *Lisowski, Malaisse & Symoens 1009* (POZG). ZAMBIA. **Ndola:** Kambowa (Kamboa), *Fanshawe 519* (BR).

1b. Hypoxis bampsiana subsp. **tomentosa** Wiland, subsp. nov. TYPE: Malawi. Central Region, Lilongwe District: Dzalanyama Forest Reserve, valley NE of Kazuzu Hill, on flat rock & shallow gravel in *Brachystegia-Julbernardia* woodland, with *Xerophyta*, 1420 m, 24 Feb. 1982, *R. K.*

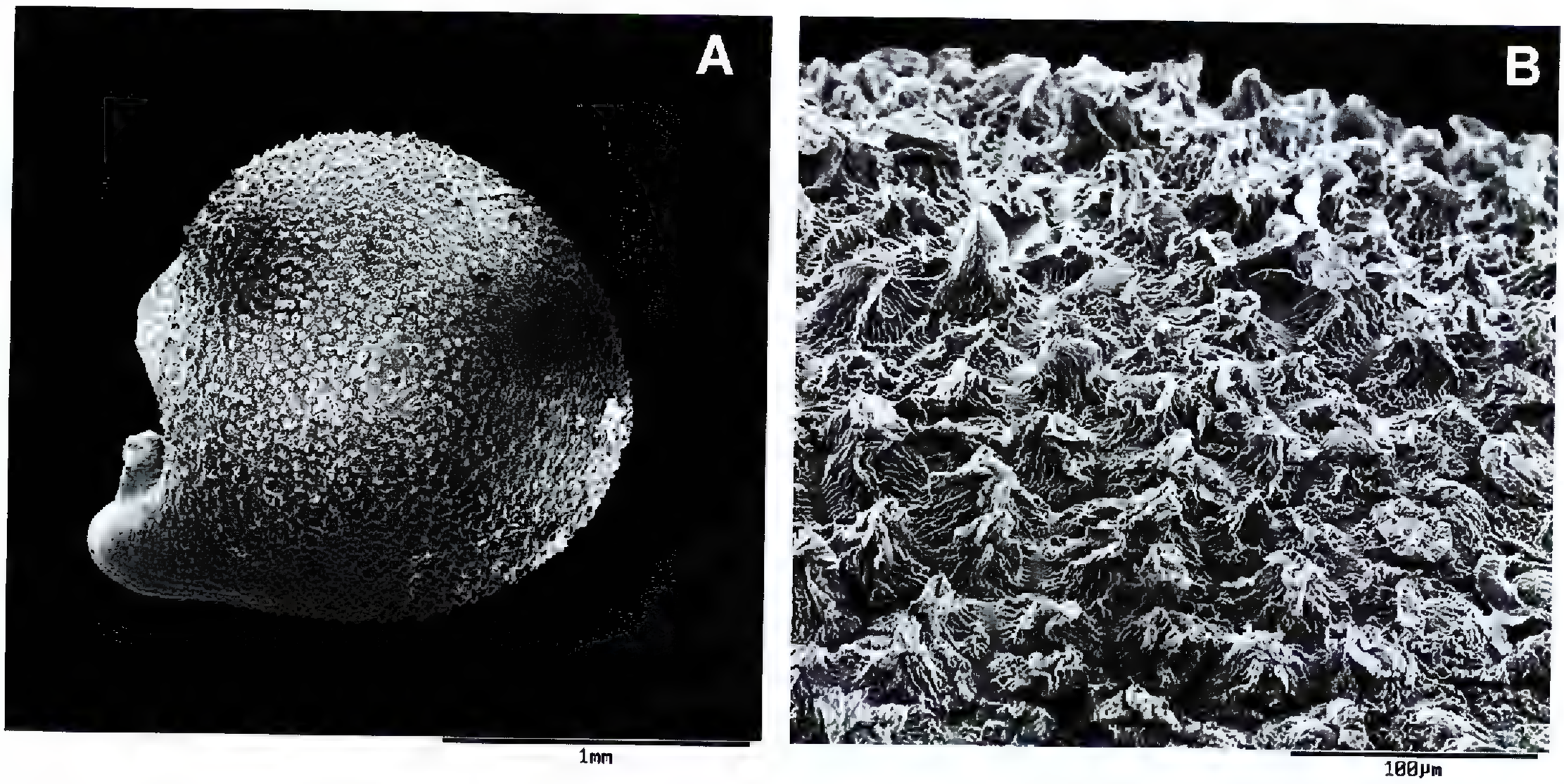

Figure 3. *Hypoxis bampsiana* subsp. *tomentosa* Wiland. —A. Seed. —B. Seed, testa covered with thick cuticle. From *Lisowski et al. 8574* (POZG).

Brummitt, R. M. Polhill & E. A. Banda 16080 (holotype, K; isotype, MAL). Figures 1, 2, 3.

Folia utrinque tomentosa, externa nervis 18 ad 49, interna nervis 17 ad 67. *Inflorescentia* 4- ad 9-flora; scapi 3 ad 8, 11–25 cm longi; perigonii segmenta exteriora ovata, acuta; perigonii segmenta interiora ovata, cuspidata; stigma trilobata.

Tuber ca. 6 × 2.8–5.5 cm. *Outer leaves* 3 to 4, 3.5–20 × (1.2–)2–4 cm; lamina tomentose on both sides, nervation of 18 to 49 veins; inner leaves 3 to 5, 13.5–46 × (8–)14–57 mm; lamina tomentose bifacially, nervation of 17 to 67 veins. *Scapes* 3 to 8, 11–25 cm × 2–4 mm. *Inflorescences* 4- to 9-flowered; bracts 0.9–2.5 cm × 2–4 mm, the lowest 3-veined; pedicels 3–18 mm; *outer tepals* ovate, acute, 13–15 × ca. 5 mm, 7-veined; *inner tepals* ovate, cuspidate, 12–15 × 7–8 mm, 5- or 6-veined; *stamens* 6 mm; filaments 2.5 mm; anthers fused or slightly emarginate at apex, 4.5–7 mm; *ovary* 4–6 × 3–4 mm; style 2–3 mm, stigma free, with 3 unequal triangular lobes. *Capsule* obconical, 6–8 × 4–5 mm.

Habitat. Grassland, miombo woodland, in sandy or rocky soil, at altitudes from 1250–2000 m.

IUCN Red List category. Hypoxis bampsiana subsp. *tomentosa* should be considered Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). There are seven known populations distributed far apart. Although no information concerning this taxon's medicinal uses was available, it is possible that it might be taken as a substitute for other more useful *Hypoxis* species. An overgrazing of the grassland ecosystem, tree cutting, soil erosion, and agriculture are threats for this taxon. The last collection available for this study was made in 1982.

Observations. One additional specimen from Nyika Plateau in Malawi (*Pawek 480*, MAL) seems to belong to this taxon; however, because only a photocopy of this specimen was available, it is not included with the paratypes.

Paratypes. DEMOCRATIC REPUBLIC OF CONGO. **Haut-Katanga:** *S. Lisowski 8570* (POZG); Marungu Plateau, 2 km E from Luonde, *S. Lisowski, F. Malaisse & J.-J. Symoens 8267* (POZG), Mont Kampilikwe, 3 km NNW from Kionta, *S. Lisowski, F. Malaisse & J.-J. Symoens 8574* (POZG); Sakania Zone, SE from Namopala, *S. Lisowski B-7278* (POZG); Kundelungu Plateau, 3 km W from Poste de Lualala, *S. Lisowski 7558B* (POZG). MALAWI. **Mzimba:** Chimpyai View, ca. 66 km SW of Mzuzu, *J. Pawek 4142* (K, MAL). TANZANIA. **Ufipa:** Chapota, open country at top of scarp, *A. A. Bullock 2045* (K); Sumbawanga, *H. M. Richards 3444* p.p. (K).

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A New Species of *Orinus* (Poaceae) from Qinghai, China

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ABSTRACT. A new species of *Orinus* Hitchcock, *O. alticulmus* L. B. Cai & Tong Lin Zhang, is described and illustrated. This species is endemic to Qinghai province, China, occurring at altitudes of 2450–2600 m on sandy soils. It resembles *O. kokonorica* (K. S. Hao) Tzvelev, but differs from that species by its slightly effuse panicles, longer spikelets usually with five or six florets, purple-yellow anthers, shorter caryopses, and the paleas usually longer than the lemmas. A key to the five species of the genus is provided.

Key words: China, IUCN Red List, *Orinus*, Poaceae.

Orinus Hitchcock was established in 1933 based on *O. arenicola* Hitchcock, which was collected from the Kashmir region. Later, another species of *Orinus*, *O. anomala* Keng ex Keng f. & L. Liou, was discovered by Keng (1957, 1959), and the name was validated by Keng and Liou (1960). However, Bor (1960) cited *O. arenicola* in the synonymy of *O. thoroldii* (Stapf ex Hemsley) Bor, which was described from Xizang (Stapf, 1894). The type species of *Orinus* shifted to *O. thoroldii*, and subsequently, Tzvelev (1968) transferred *Cleistogenes kokonorica* K. S. Hao to *Orinus*, viz. *O. kokonorica* (K. S. Hao) Tzvelev, with Zhao (1994) describing a new species, *O. tibeticus* N. X. Zhao, from Xizang. Now, the genus *Orinus* contains altogether four taxa.

The four species of *Orinus* are restricted to the Qinghai-Xizang Plateau in Central Asia and are endemic there. They usually grow along riverbanks, lakesides, mountain slopes, and grasslands at elevations of 2230–5200 m, and have tender culms and leaves and well-developed, perennial root systems in gross morphology. Therefore, all members of the genus are used as forage grasses in animal husbandry and as a binder and stabilizer of shifting sands and soils at these high altitudes. It is because of the economic importance of *Orinus* that we have studied the genus since 2004. As a part of this research, we have checked all specimens of *Orinus* preserved in the HNWP herbarium. As a result, several specimens belonging to a previously unrecognized or misdeemed taxon of *Orinus* were found. In autumn 2005, we also collected some specimens in the Xi Mountains, Xining, Qinghai, China. Subsequently, through the comparison of the morphological features of these new specimens with those of the other four species, we confirmed that this taxon represents a new species of *Orinus*. Especially notable, it has taller culms, to as much as 75 cm, which differ from those of the other known species of the genus.

Orinus alticulmus L. B. Cai & Tong Lin Zhang, sp. nov. TYPE: China. Qinghai: Xining Shi, Yangjiazhai, near Xining Botanical Garden, ca. 36°36′N, 101°48′E, 2450 m, 14 Aug. 1985, *Y. H. Wu 1913* (holotype, HNWP; isotype, PE). Figure 1.

Herbae perennes, rhizomatosae; culmi (28–)40–75 cm alti, sub nodis pubescentes. Laminae utrinque glabrae. Paniculae leviter effusae, 6–20 cm longae. Spiculae stramineae, 8–10 mm longae, 5- ad 6-florae; glumis lanceolatis, glabris, dorso carinatis, margine membranaceis, apice obtusis, gluma prima 1-nervi, 4–5 mm longa, gluma secunda 3-nervi, 4.5–6 mm longa; lemmatibus 3-nervibus, dorso leviter carinatis, secus vel juxta carinas et nervos sparsim pilosis, lemmate primo 4.5–5.5 mm longo; paleis lemmatibus generatim longioribus; antheris purpureoflavis. Caryopsides 2.2–2.6 mm longae.

Perennial herbs; rhizomes 4–13 cm, 1–3 mm diam. at the base, densely lepidote, with short internodes; culms erect, loosely caespitose, (28–)40–75 cm tall, 1.3–2.2 mm diam., 5- to 6-noded, pubescent under the nodes. Leaf sheaths glabrous, longer than the internodes; ligules membranous, rather short, laciniate; leaf blades flat or involute, 8–14 cm × 2–3.5 mm, glabrous abaxially and adaxially. Panicles slightly effuse, 6–20 cm, with 4 to 7 racemose branches; branches solitary, scabrous, 1–5 cm. Spikelets stramineous, 8–10 mm, 5- to 6-flowered; rachilla internodes pubes-

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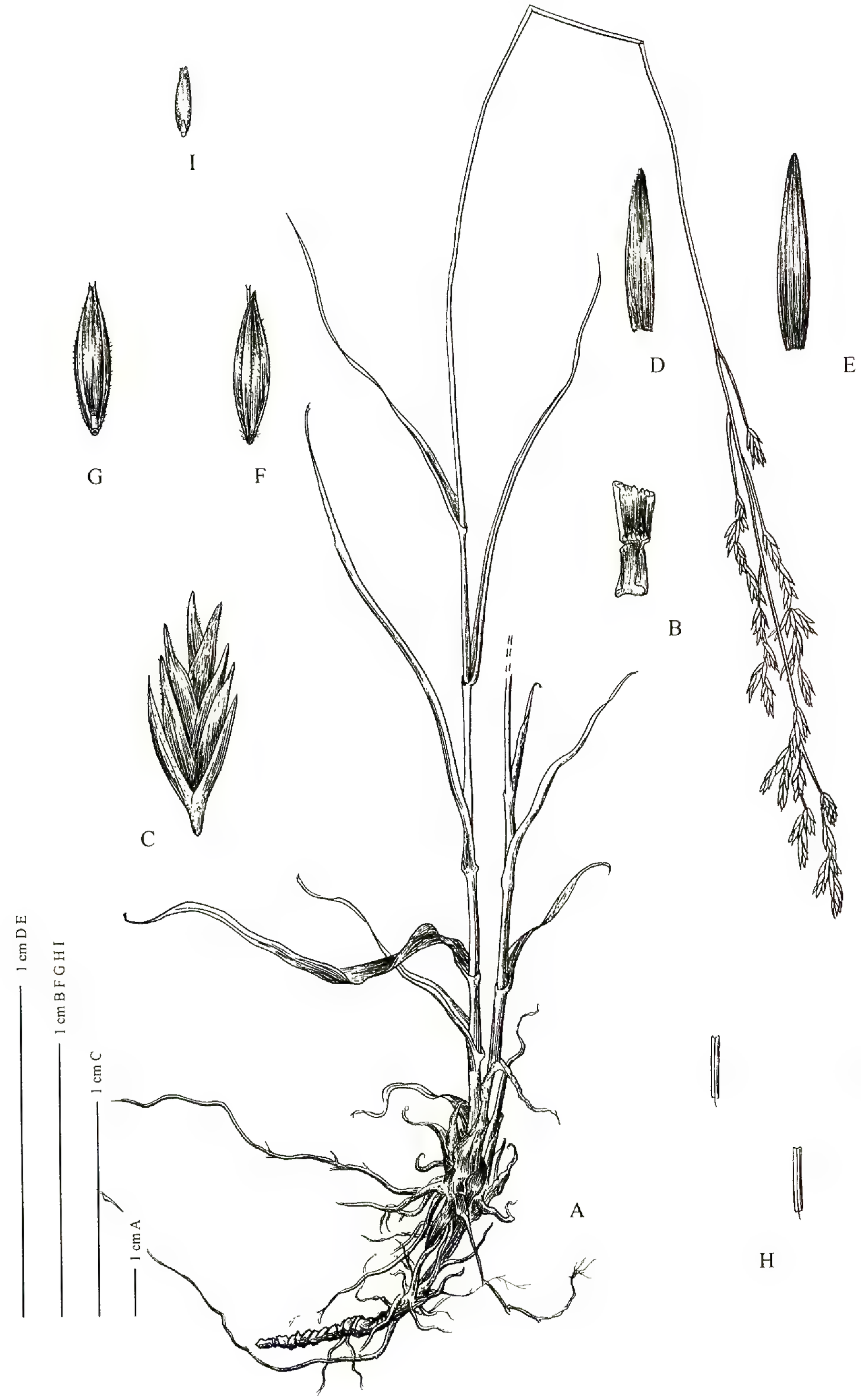

Figure 1. *Orinus alticulmus* L. B. Cai & Tong Lin Zhang. —A. Mature plant with rhizome. —B. Junction of sheath and blade showing ligule. —C. Spikelet. —D. First glume. —E. Second glume. —F. First floret, dorsal view. —G. First floret, ventral view. —H. Anthers. —I. Caryopsis. Drawn from the holotype *Y. H. Wu 1913* (HNWP).

cent, ca. 1 mm; glumes lanceolate, glabrous, keeled on the back, membranous along the margins, obtuse at the apex, shorter than adjacent florets; the first glumes 1-nerved, 4–5 mm, the second glumes 3-nerved, 4.5–6 mm; lemmas lanceolate, slightly keeled on the back, 3-nerved, sparsely pilose along or near the keels and veins, obtuse at the apex; the first lemmas 4.5–5.5 mm; paleas generally longer than the lemmas, with

Table 1. Morphological differences among five *Orinus* species.

Character	*O. anomala*	*O. alticulmus*	*O. kokonorica*	*O. thoroldii*	*O. tibeticus*
Plant	15–50 cm tall, culms and leaves pubescent at some parts	(28–)40–75 cm tall, only culms pubescent at some parts	20–50 cm tall, only leaves spinulate at some parts	12–50 cm tall, culms and leaves villose at some parts	15–35 cm tall, culms and leaves villose at all parts
Rhizome	usually 1.5–8 cm, 1–2 mm diam. at the base	usually 4–13 cm, 1–3 mm diam. at the base	usually 3–10 cm, 1–2 mm diam. at the base	usually 5–15 cm, 1–3 mm diam. at the base	usually 4–13 cm, 1.5–3 mm diam. at the base
Panicle	linear, 3–10 cm	slightly effuse, 6–20 cm	linear, 5–19 cm	slightly effuse, 4–15 cm	slightly effuse, 3–9 cm
Spikelet	stramineous or glaucous, 5–6 mm, only 1- to 2-flowered	stramineous, 8–10 mm, usually 5- to 6-flowered	viridescent or stramineous, 6.5–8.5 mm, usually 2- to 4-flowered	dark brown or purplish brown, 6–8.5 mm, usually 2- to 4-flowered	dark brown or purplish brown, 8–11 mm, usually 5- to 8-flowered
Glume	glabrous, first glumes 3–4 mm, second glumes 4–4.5 mm	glabrous, first glumes 4–5 mm, second glumes 4.5–6 mm	glabrous, first glumes 3.5–5 mm, second glumes 4–6 mm	glabrous, first glumes 4.5–6 mm, second glumes 5–7 mm	glabrous or sparsely pilose, first glumes 4.5–5.5 mm, second glumes 5–6 mm
Lemma	sparsely pubescent, first lemmas 4–5 mm	sparsely pilose, first lemmas 4.5–5.5 mm	sparsely pilose, first lemmas 4.5–5.5 mm	densely or sparsely villose, first lemmas 5–6.5 mm	densely villose, first lemmas 5–6 mm
Palea	equal to or slightly shorter than the lemmas	usually longer than the lemmas	subequal to the lemmas	slightly shorter than the lemmas	equal to or slightly shorter than the lemmas
Anther	orange, 1.5–2.1 mm	purple-yellow, 1.5–2.4 mm	yellowish, 1.6–2.6 mm	yellow or purple-yellow, 2–3 mm	yellow, 2.7–3 mm
Caryopsis	1.8–2.5 mm	2.2–2.6 mm	2.6–3 mm	2.4–3 mm	2.4–2.9 mm

emarginate apex, sparsely pilose along and near 2 keels; anthers purple-yellow, 1.5–2.4 mm. Caryopses brown, narrowly oblong, 2.2–2.6 mm.

Distribution and habitat. *Orinus alticulmus* is known only from three localities in Gonghe and Xining regions in the eastern part of Qinghai province, China. The type locality is a woodland at 2450 m in altitude. Two paratypes were collected from a grassland about 5 km distant from the type locality, at ca. 2500 m. An additional two specimens were found on mountain slopes at 2600 m in altitude. All three localities have sandy soils.

IUCN Red List category. Because the geographic range of *Orinus alticulmus* is estimated to be less than 10,000 km^2 and its range is fragmented and limited to the sandy soils of fewer than four localities, we preliminarily classify this species as Endangered (EN) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet is from the Latin "altus" and "culmus," referring to the tall culms of the new species.

Relationships. *Orinus alticulmus* is classified in the genus *Orinus* based mainly on its external characteristics (Hitchcock, 1933; Bor, 1952; Keng, 1957, 1959; Liou, 1987; Yang, 1990; Lu, 1999). Namely, the new species has long and lepidote rhizomes, 1- to 3-nerved glumes, pilose lemmas, and panicles composed of racemose branches, and it grows on sandy soils. The new species is most similar to *O. kokonorica* by its longer panicles (up to 20 cm), glabrous and keeled glumes, and sparsely pilose lemmas. However, the new species clearly differs from the four established species in the genus (Table 1). For example, it differs from *O. anomala* in the shape of the panicle and number of florets; it differs from *O. tibeticus* in the length of the panicle and types of hairs of the lemma; and it differs from *O. thoroldii* in the number of florets per spikelet and the length of the palea. Furthermore, *O. alticulmus* is distinguished from the closely related *O. kokonorica* by its slightly effuse panicles, longer spikelets (8–10 mm) usually with five or six florets, purple-yellow anthers, often shorter caryopses (2.2–2.6 mm), and the paleas usually longer than the lemmas. *Orinus alticulmus* especially differs from all species of the genus by its taller culms (usually 40–75 cm). These species can be distinguished by the key provided here.

Paratypes. CHINA. **Qinghai:** Xining Shi, Xi Mtns., Xishanlinchang, ca. 2500 m, 13 Aug. 1985, *Veget. Geogr. Exped. 889* (HNWP); 2 Aug. 2005, *L. B. Cai & B. H. Ma 001* (HNWP); Gonghe County, Longyangxia, 2600 m, 17 Aug. 1983, *Longyangxia Exped. 002, 019* (HNWP).

Key to the Species of *Orinus* in China

1a. Lemmas densely villose, the first lemmas 5–6.5 mm long; spikelets dark brown or purplish brown. 2
1b. Lemmas sparsely pilose, the first lemmas 4–5.5 mm long; spikelets usually stramineous or viridescent 3
2a. Spikelets 6–8.5 mm long, usually 2- to 4-flowered; culms and leaves villose at some parts. . . *O. thoroldii*
2b. Spikelets 8–11 mm long, usually 5- to 8-flowered; culms and leaves villose at all parts . . . . . *O. tibeticus*
3a. Spikelets 5–6 mm long, only 1- to 2-flowered; lemmas sparsely pubescent. . . . . *O. anomala*
3b. Spikelets 6.5–10 mm long, usually 2- to 6-flowered; lemmas sparsely pilose. 4
4a. Panicles linear; spikelets usually 2- to 4-flowered; paleas subequal to lemmas; leaves spinulate in part. . . . . *O. kokonorica*
4b. Panicles slightly effuse; spikelets usually 5- to 6-flowered; paleas usually longer than lemmas; leaves not spinulate. . . . . *O. alticulmus*

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New or Noteworthy *Streptanthus* (Brassicaceae) for the Flora of North America

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ABSTRACT. *Streptanthus glandulosus* Hooker subsp. *josephinensis* Al-Shehbaz & M. Mayer (Brassicaceae) is described as new. The new combinations *S. glandulosus* subsp. *niger* (Greene) Al-Shehbaz, M. Mayer & D. W. Taylor, *S. glandulosus* subsp. *sonomensis* (Kruckeberg) M. Mayer & D. W. Taylor, and *S. vimineus* (Greene) Al-Shehbaz & D. W. Taylor, as well as a new status for *S. glandulosus* subsp. *albidus* (Greene) Al-Shehbaz, M. Mayer & D. W. Taylor and *S. glandulous* subsp. *hoffmanii* (Kruckeberg) M. Mayer & D. W. Taylor, are proposed. A key to the eight subspecies of *S. glandulosus* is presented. *Mesoreanthus fallax* Greene and *S. sparsiflorus* Rollins are reduced to synonymy of *S. vimineus* and *S. platycarpus* A. Gray, respectively. The names *M. vimineus* Greene and *S. niger* Greene are lectotypified. The IUCN status of *S. glandulosus* subsp. *josephinensis* is given as Critically Endangered (CE).

Key words: Brassicaceae, IUCN Red List, *Streptanthus*.

During work on the treatment of *Streptanthus* Nuttall (Brassicaceae) for the Flora of North America (hereafter FNA), several thousand specimens, including the types of all taxa, were examined from all of the major herbaria in the United States. As a result, the description of the following novelties and nomenclatural adjustments became evident. These are dealt with herein to make the names available for the forthcoming Volume 7 of FNA.

THE *STREPTANTHUS GLANDULOSUS* COMPLEX

The *Streptanthus glandulosus* Hooker complex has been subjected to extensive taxonomic studies (Morrison, 1941; Kruckeberg, 1958), crossing and fertility relationships (Kruckeberg, 1957), and ecological (Kruckeberg, 1969; Shapiro, 1981), phytochemical (Rodman et al., 1981), and molecular studies (Mayer & Soltis, 1994, 1999; Mayer et al., 1994). The total number of species assigned to this complex varied from 12 (Greene, 1904) to three with five subspecies and two varieties (Kruckeberg, 1958; Buck et al., 1993; Rollins, 1993). Molecular studies by one of the authors (Mayer & Soltis, 1994, 1999; Mayer et al., 1994; Mayer, unpublished data) clearly demonstrate that a single species with at least eight infraspecific taxa should be recognized. *Streptanthus albidus* Greene and *S. niger* Greene, which were recognized as distinct species by Kruckeberg (1958; Buck et al., 1993; Rollins, 1993), were shown in those molecular studies to be nested within the larger and more widespread *S. glandulosus*. The following novelty and new combinations are proposed, and a key to all eight subspecies of *S. glandulosus*, including *S. glandulosus* subsp. *pulchellus* (Greene)

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Kruckeberg and *S. glandulosus* subsp. *secundus* (Greene) Kruckeberg, is presented.

1. Streptanthus glandulosus Hooker, Icones Pl. 1: tab. 40. 1836. TYPE: U.S.A. California: [Monterey Co.], Monterey, *David Douglas s.n.* (holotype, K).

1a. Streptanthus glandulosus subsp. **glandulosus**.

Distribution. San Luis Obispo County north into Santa Clara, Lake, and Mendocino counties, California.

1b. Streptanthus glandulosus subsp. **albidus** (Greene) Al-Shehbaz, M. Mayer & D. W. Taylor, stat. nov. Basionym: *Streptanthus albidus* Greene, Pittonia 1: 62. 1887. *Euclisia albida* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 83. 1904. *Streptanthus glandulosus* var. *albidus* (Greene) Jepson, Man. Fl. Pl. Calif. 419. 1925. TYPE: U.S.A. California: Santa Clara Co., hills 4 mi. S of San Jose, 30 Apr. 1887, *Rattan s.n.* (holotype, NDG).

Distribution. Mount Hamilton Range, Santa Clara County, California.

1c. Streptanthus glandulosus subsp. **hoffmanii** (Kruckeberg) M. Mayer & D. W. Taylor, stat. nov. Basionym: *Streptanthus glandulosus* var. *hoffmanii* Kruckeberg, Madroño 14: 223. 1958. TYPE: U.S.A. California: Sonoma Co., Russian Gulch, 8 mi. S of Fort Ross, 400 ft., 24 Apr. 1938, *L. Constance 2155* (holotype, UC; isotypes, GH, MO).

Distribution. Sonoma County, California.

1d. Streptanthus glandulosus subsp. **josephinensis** Al-Shehbaz & M. Mayer, subsp. nov. TYPE: U.S.A. Oregon: Josephine Co., serpentine soil 6.9 mi. N of California–Oregon line on Happy Camp–O'Brien rd., 9 July 1948, *F. W. Hoffman 2311* (holotype, MO; isotypes, GH, UC).

Herba annua; caules 1.7–3.8 dm, inferne pubescentes, superne glabri. Folia caulina sparse pubescentia, dentata. Racemi secundi, rhachidibus rectis; pedicelli fructiferi 5–10 mm longi. Sepala alba, 3–5 mm longa, glabra vel sparsim pubescentia; petala purpureo-venosa, 7–8 mm longa; filamenta adaxialia 5–6 mm longa. Fructus glabrae vel sparse pubescentes, rectae vel incurvatae, divaricatim adscendentes.

Annual herbs; stems 1.7–3.8 dm, moderately pubescent abaxially, glabrous adaxially. Cauline leaves sparsely pubescent, upper ones flat, dentate. Racemes secund; rachis straight; fruiting pedicels 5–10 mm, glabrous or sparsely pubescent. Flowers: sepals white or cream, 3–5 mm, glabrous or sparsely pubescent; petals white with purple veins, 7–8 mm; adaxial filaments 5–6 mm. Fruits glabrous or sparsely pubescent, straight or curved inward, divaricate-ascending.

Discussion. Plants of *Streptanthus glandulosus* subsp. *josephinensis*, which are known from a few collections from Josephine County (southwestern Oregon), are disjunct from the other white-flowered Californian subspecies of *S. glandulosus*. Both Rollins (1993) and Buck et al. (1993) erroneously attributed them to subspecies *glandulosus* and subspecies *secundus*, respectively. From subspecies *glandulosus*, subspecies *josephinensis* is readily distinguished by its secund flowers and fruits and from subspecies *secundus* by the fruit orientation and length of petals and stamens (see key below). Because subspecies *josephinensis* is known from only three collections, the last two of which were made in 1948, the conservation status of the taxon is recognized herein as Critically Endangered (CE; IUCN, 2001). Mayer and Soltis (1994) included a sample from the type locality of subspecies *josephinensis* and found its chloroplast DNA divergence to be substantial, clearly setting it apart from the other populations of subspecies *secundus*.

Paratypes. U.S.A. **Oregon:** Josephine Co., Waldo, *T. Howell 39* (GH); Josephine Co., serpentine soil 11 mi. E of O'Brien, Waldo–Happy Camp rd., *F. W. Hoffman 3387* (GH).

1e. Streptanthus glandulosus subsp. **niger** (Greene) Al-Shehbaz, M. Mayer & D. W. Taylor, comb. nov. Basionym: *Streptanthus niger* Greene, Bull. Torrey Bot. Club 13: 141. 1886. *Euclisia nigra* (Greene) Greene, Leafl. Bot. Observ. Crit. 1: 83. 1904. *Streptanthus glandulosus* var. *niger* (Greene) Munz, Aliso 4: 91. 1958. TYPE: U.S.A. California: Marin Co., Point Tiburon, Apr. 1886, *E. L. Greene s.n.* (lectotype, designated here, NDG).

Distribution. Endemic to Tiburon Peninsula in Marin County, California.

Discussion. Greene (1886) cited two collections he made in April and May of 1886; the one collected in May has mature fruits and no flowers, whereas that collected in April has flowers with the characteristic dark purple-black calyx. The latter collection is designated herein as the lectotype.

1f. Streptanthus glandulosus subsp. **sonomensis** (Kruckeberg) M. Mayer & D. W. Taylor, comb. nov. Basionym: *Streptanthus glandulosus* subsp. *secundus* (Greene) Kruckeberg var. *sonomensis* Kruckeberg, Madroño 14: 223. 1958. TYPE: U.S.A. California: Sonoma Co., near Guerneville, Great Eastern Quicksilver Mine, serpentine,

1948, *F. W. Hoffman 2323* (holotype, US; isotypes, GH, MO).

Distribution. Endemic to Sonoma County, California.

KEY TO THE SUBSPECIES OF *STREPTANTHUS GLANDULOSUS*

1a. Rachis of raceme flexuous; lower stems and cauline leaves glabrous; fruiting pedicels 1–3.2 cm; sepals dark purple-black. . . . . *S. glandulosus* subsp. *niger*
1b. Rachis of raceme straight; plants sparsely to densely hirsute; fruiting pedicels 0.2–1.5 cm; sepals white, lilac, lavender, purple, or reddish purple.
2a. Racemes not secund.
3a. Sepals white, greenish white, or pale yellow; Santa Clara Co., California . . . . . *S. glandulosus* subsp. *albidus*
3b. Sepals reddish purple, dark maroon, or lilac-lavender; San Luis Obispo Co. north into Santa Clara, Lake, and Mendocino counties, California . . . . . *S. glandulosus* subsp. *glandulosus*
2b. Racemes secund.
4a. Sepals lavender to rose or purple.
5a. Fruiting pedicels 2–5 mm; fruits curved upward, divaricate to ascending; adaxial filaments 6–8 mm; Marin Co., California . . . . . *S. glandulosus* subsp. *pulchellus*
5b. Fruiting pedicels 5–15 mm; fruits arcuate, spreading to reflexed; adaxial filaments 7–10 mm; Sonoma Co., California . . . . . *S. glandulosus* subsp. *hoffmanii*
4b. Sepals greenish white, white, cream, or pale yellow.
6a. Petals 7–8 mm; adaxial stamens 5–6 mm; fruits divaricate-ascending, straight or curved inward; Josephine Co., Oregon . . . . . *S. glandulosus* subsp. *josephinensis*
6b. Petals 10–17 mm; adaxial stamens 5–6 mm; fruits spreading to reflexed, arcuate; Marin, Napa, and Sonoma counties, California.
7a. Sepals greenish white with lavender or purplish base; petals with purple veins; Marin and Napa counties, California. . . . . *S. glandulosus* subsp. *secundus*
7b. Sepals cream or pale yellow, without purplish or lavender base; petals without purple veins; Sonoma Co., California . . . . . *S. glandulosus* subsp. *sonomensis*

STREPTANTHUS PLATYCARPUS

Rollins (1970, 1993) distinguished *Streptanthus platycarpus* A. Gray from *S. sparsiflorus* Rollins solely on the basis of the former having petiolate and non-auriculate (vs. sessile and auriculate) lowermost cauline leaves. However, a closer examination of the types of both species and other collections reveals that this alleged difference is tenuous at best. Collections of both are otherwise indistinguishable in every morphological aspect of the leaves, racemes, flowers, fruits, and seeds. Therefore, *S. sparsiflorus* is reduced herein to synonymy of *S. platycarpus*.

2. Streptanthus platycarpus A. Gray, Smithsonian Contr. Knowl. 5: 10. 1853. TYPE: U.S.A. Texas: stony hills, Valley of the Pecos, June 1851, *C. Wright 844* (holotype, GH; isotypes, GH, MO).

Streptanthus sparsiflorus Rollins, Contr. Gray Herb. 200: 190. 1970. Syn. nov. TYPE: U.S.A. Texas: Culberson Co., S fork of McKittrick Canyon, Guadalupe Mtns., 21 June 1964, *D. S. Correll & C. Hanson 29805* (holotype, GH; isotypes, LL, UC).

STREPTANTHUS VIMINEUS AND *S. FALLAX*

Various North American authors (e.g., Kruckeberg & Morrison, 1983; Buck et al., 1993; Rollins, 1993) either ignored *Mesoreanthus vimineus* Greene or treated it, along with *M. fallax* Greene, as a synonym of *Streptanthus barbiger* Greene. These authors treated *S. barbiger* as having both auriculate and non-auriculate cauline leaves. An examination of a wide series of specimens, including the type collections of the three taxa, reveals that two species are involved. *Streptanthus barbiger* is easily distinguished from all of the Californian congeners by having sessile, non-auriculate, linear cauline leaves. By contrast, *S. vimineus*, including *M. fallax*, has well-developed auricles on all cauline leaves. The type collection of *M. fallax* consists of fruiting material with only a few fragments of cauline leaves, whereas the type collection of *S. vimineus* is flowering material with many cauline leaves and no fruits. As a result, the two plants might have looked different to Greene (1904), who treated them as distinct species. This paper gives the first complete description and citations of specimens for *S. vimineus*.

3. Streptanthus vimineus (Greene) Al-Shehbaz & D. W. Taylor, comb. nov. Basionym: *Mesoreanthus vimineus* Greene, Leafl. Bot. Observ. Crit. 1: 90. 1904. TYPE: U.S.A. California: Lake Co., near Lakeport, common along stony hills, 9 May 1903, *C. F. Baker 3059* (lectotype, designated here, NDG 37471; isotypes, GH, LL, NDG[2]).

Mesoreanthus fallax Greene, Leafl. Bot. Observ. Crit. 1: 90. 1904. TYPE: U.S.A. California: Napa Co., St. Helena, July 1891, *E. L. Greene s.n.* (holotype, US; isotypes, GH, NDG[2]).

Annual herbs, glabrous throughout except sometimes for sepals, glaucous; stems 1–7.5 dm tall, erect, branched above base. Basal leaves not rosulate, petiolate, soon withered, narrowly ovate to oblong,

entire, 2.5–5 cm; cauline leaves linear to narrowly linear-lanceolate, 2–12 cm × 1–3(–4) mm, entire, sessile, auriculate at base; upper leaves similar, reduced. Racemes ebracteate, usually secund, lax, without a terminal cluster of sterile flowers; fruiting pedicels divaricate, straight, 1–3(–6) mm. Flowers: sepals forming urceolate calyx, pale green to pale purple, ovate-lanceolate, 6–8 mm, keeled, recurved at apex, glabrous or rarely sparsely pubescent; petals white with purple veins on abaxial pair, unequal, 8–12 mm; abaxial pair longer; blade 3–5 × 2–3 mm, not crisped; claw 5–7 mm, narrower than blade; filaments in 3 pairs of unequal length; adaxial pair united full length, 7–11 mm, recurved; abaxial pair 4–7 mm, united to middle; lateral pair 2–4 mm; anthers of adaxial stamens sterile, 0.5–1.2 mm; anthers of abaxial and lateral stamens fertile, 2–2.7 mm. Fruits 3.5–6.5 cm × 1–1.2 mm, divaricate, recurved, flattened, slightly torulose; valves glabrous, with obscure midvein; gynophore 0.2–0.5 mm; replum straight; style 0.1–0.3 mm; stigma entire; ovules and seeds 28 to 40 per fruit; seeds narrowly oblong, 1–1.5 × 0.6–0.8 mm; wing absent or distal and ca. 0.1 mm wide.

Discussion. Two sheets of the *Streptanthus vimineus* collection are at NDG; the sheet originally received by Greene and carrying his handwriting as "*Streptanthus vimineus* Greene, n. sp.," not the one with a printed label and distributed later, is taken herein as the lectotype. Oddly, the name *S. vimineus* was never published.

Both *Mesoreanthus vimineus* and *M. fallax* were published simultaneously by Greene (1904). The reduction herein of the latter name to synonymy of the former gives the name *M. vimineus* priority (see Article 11.5 in McNeill et al., 2006).

Specimens examined. U.S.A. **California:** Colusa Co., Fouts Springs, June 1882, *Rattan s.n.* (GH); Lake Co., S of jct. of Hwy. 175 & 29, ca. 2 mi. S of Lakeport, *Taylor 16470* (JEPS); Lake Co., Lakeport, *Mason 12309* (GH, MO); Lake Co., Hopland rd. & Highland Springs rd., near Lakeport, *Jepson 20817* (JEPS); Lake Co., slopes of Bear Creek, tributary to Middle Fork Eel River, at Bear Creek Public Camp, Mendocino Natl. Forest, *Sharsmith 4391* (GH); Lake Co., 2 mi. S of Lakeport, *Nelson & Nelson 9200* (MO); Lake Co., Rice Creek, *Hoffman 2293* (GH, MO); Lake Co., Howard Springs, *Hoffman 2325* (MO); Lake Co., Rice Creek Camp, *Hoffman 4259* (GH, MO, UC); Napa Co., Conn Dam, *Hoffman 1048* (MO); Napa Co., St. Helena Reservoir, Spring Mt. rd., *Hoffman 2329* (UC).

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Una Especie Nueva de *Habranthus* (Amaryllidaceae, Hippeastreae) para la Flora del Valle de Tehuacán-Cuicatlán

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Resumen. Se describe una especie nueva, *Habranthus medinae* L. O. Alvarado & García-Mendoza (Amaryllidaceae, Hippeastreae), del estado de Puebla, México. La especie nueva es parecida a *H. tubispathus* (L'Héritier) Traub, pero se puede distinguir por el mayor tamaño de las estructuras florales y sus anteras pardas. Se proporciona también una clave para la identificación de las especies mexicanas de *Habranthus* Herbert.

Abstract. A new species, *Habranthus medinae* L. O. Alvarado & García-Mendoza (Amaryllidaceae, Hippeastreae), from the state of Puebla, Mexico, is described. The new species is similar to *H. tubispathus* (L'Héritier) Traub, but can be distinguished by the larger size of the floral structures and its brown anthers. A key to the Mexican species of *Habranthus* Herbert is provided.

Key words: Amaryllidaceae, *Habranthus*, Hippeastreae, IUCN Red List, Mexico.

Habranthus Herbert es un género nativo de América con alrededor de 30 especies (Meerow & Snijman, 1998). Las especies de este género han sido ocasionalmente incluidas dentro de *Zephyranthes* Herbert, ya que se ha considerado que las características que distinguen a estos géneros son subjetivas (Howard, 1996; Fernández-Alonso & Groenendijk, 2004). Existen algunos trabajos cladísticos para la familia Amaryllidaceae, basados en marcadores moleculares (Meerow, 1995; Meerow et al., 2000), que incluyen a ambos taxones, pero los resultados de estas filogenias junto con trabajos taxonómicos (McVaugh, 1989; Arroyo, 1990) mencionan que aún falta mucho por entender sobre las relaciones entre estos y los restantes géneros dentro de la complicada tribu Hippeastreae.

En éste trabajo se considera *Habranthus* como una entidad válida, con base en las características propuestas por Meerow y Snijman (1998), como son la inserción de los estambres en la base del tubo, sus diferentes longitudes y la presencia de un paraperigonio o corona. La revisión de material de herbario y bibliográfico permitía reconocer seis especies del género en México, de las cuales cinco son endémicas.

La revisión del material colectado para la flora del Valle de Tehuacán-Cuicatlán (Puebla-Oaxaca, México) ha resultado en el descubrimiento de una especie nueva de *Habranthus*, la cual se describe a continuación.

Habranthus medinae L. O. Alvarado & García-Mendoza, sp. nov. TIPO: México. Puebla: Mpio. Caltepec, La Cumbre, cerca del cerro El Gavilán, de Caltepec a San Luis Tultitlanapa 2 km, 9 jul. 2002, *L. Alvarado C., R. Medina L., E. M. Lira C. y J. Sandoval 130* (holotipo, MEXU; isotipos, IEB, MO). Figuras 1, 2.

Habrantho tubispatho (L'Héritier) Traub similis, a quo differt perigonio grandiore 3.5–4.9 cm longo (non 2.1–3.1 cm), stylo longiore 2.7–4.8 cm longo (non 1.8–2.0 cm), maculis circa dimidium longitudinis perianthi attingentibus, et antheris brunneis.

Hierbas perennes, caducifolias, 30–35 cm alto; bulbos 3.0–4.2 × 2.4–2.6 cm, subglobosos, tunicados, cubiertos por catáfilas membranáceas, pardas; raíces fibrosas. Hojas 18–29 cm × ca. 2.0 mm, lineares, crasas, coetáneas con las flores, decumbentes. Inflorescencias escaposas, unifloras; escapo 25.1–29.3 cm × 3–4 mm, hueco; brácteas 3.1–4.7 cm, espatiformes, fusionadas 2/3 o más de su longitud, ápice no dividido, agudo, blanquecinas; pedicelos 5.0–6.3 cm. Flores infundibuliformes, erectas, 3.5–4.9 cm; tubo ca. 2.0 × 4.8 mm, segmentos externos del perigonio 3.5–4.7 × 1.8–2.0 cm, los internos 3.3–4.7 × 1.2–1.7 cm, elípticos a espatulados, agudos, amarillos con una mácula pardo-rojiza en ambas caras, 1.2–1.8 cm; garganta con paraperigonio de escamas fimbriadas; estambres

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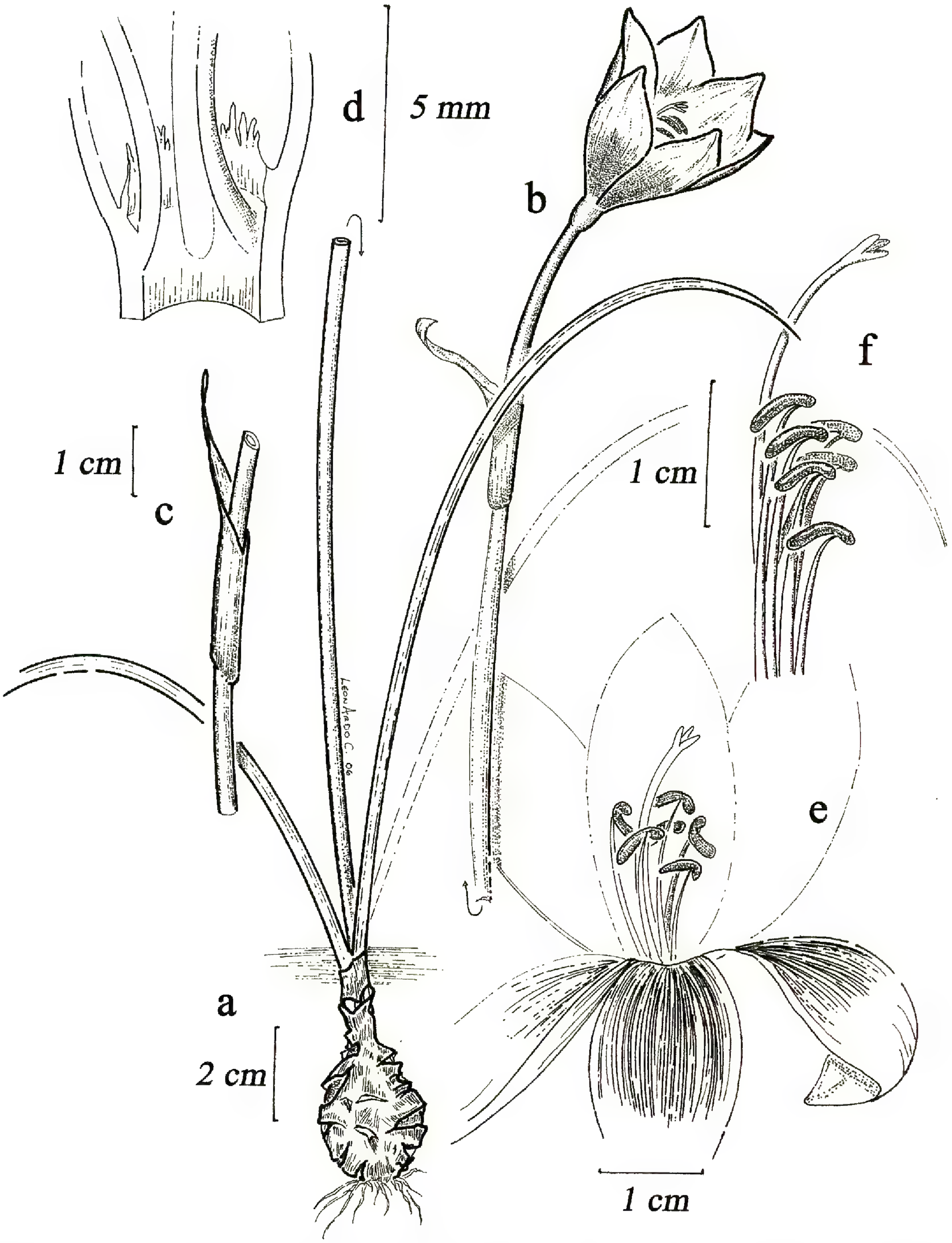

Figura 1. *Habranthus medinae* L. O. Alvarado & García-Mendoza. —A. Hábito. —B. Flor. —C. Bractea. —D. Detalle del paraperigonio. —E. Flor abierta. —F. Estambres y estilo. Dibujo basado en el holotipo (*L. Alvarado C., R. Medina L., E. M. Lira C. y J. Sandoval 130*, MEXU).

6, desiguales en longitud dispuestos en 4 grupos: 0.9–1.0 cm, 1.2–1.3 cm, 1.4–1.5 cm y 1.6 cm, declinados; filamentos fijados a 1/3 de la longitud de las anteras; anteras 5.0–7.5 mm, lunuladas, pardas; ovario 6–9 × 5–7 mm; óvulos dispuestos en dos series, 12 o más por lóculo; estilo 2.7–4.8 cm, declinado; estigma trífido, ramas 2–4 mm. Cápsulas y semillas desconocidas.

Figura 2. Individuos de *Habranthus medinae* L. O. Alvarado & García-Mendoza en floración en la localidad tipo.

Hábitat. *Habranthus medinae* sólo se conoce del ejemplar tipo colectado en el estado de Puebla, México. Esta especie crece en la base del cerro El Gavilán con una vegetación de matorral xerófilo subinerme, a una altitud de 2120 m.

Discusión. *Habranthus medinae* tiene un perigonio de color amarillo (Fig. 2), presentando cierto parecido con *H. howardii* (Traub) T. M. Howard, especie de Nuevo León (México) y Laredo (Texas, E.U.A.), pero que se distingue por ser plantas coetáneas (vs. histerantas en *H. howardii*) y presentar una mácula en cada tépalo (vs. tépalos sin mácula). Sin embargo, tiene mayor semejanza con *H. tubispathus* con flores de color amarillo, que ocasionalmente presentan también tonos rojizos en el perigonio (Flagg et al., 1993). No obstante, *H. medinae* se diferencia de ésta por el ancho de sus hojas (ca. 2.0 mm vs. ca. 4.0 mm en *H. tubispathus*), el tamaño de la bráctea (3.1–4.7 cm vs. 1.9–3.1 cm), el tamaño del perianto (3.3–4.7 cm vs. 2.1–3.1 cm), la longitud del estilo (2.7–4.8 cm vs. 1.8–2.0 cm) y el color pardo de las anteras (amarillas en *H. tubispathus*). Además, las máculas en *H. tubispathus*, si las presentan, se restringen a la porción proximal del perigonio, mientras que en *H. medinae* ocupan casi la 1/2 de la longitud del perigonio. La distribución de ambas especies no se traslapa (*H. medinae* en Puebla y *H. tubispathus* en el suroeste de Estados Unidos de América y en Sudamérica), lo que facilita la identificación de las mismas. La región donde se encontró *H. medinae* está bien colectada y apartada de las poblaciones humanas; también, nunca se ha visto cultivada o colectada en ninguna localidad en México, por lo que es improbable que se trate de una especie introducida como sucedió con *H. tubispathus* (Holmes & Wells, 1980).

La descripción de esta nueva especie incrementa a siete las especies de *Habranthus* reconocidas para México y representa la segunda especie endémica para la Flora del Valle de Tehuacán-Cuicatlán, junto con *H. vittatus* T. M. Howard, colectada en el estado de Oaxaca (Howard, 1990). Debido a que se carece de información relevante sobre las características de la población y biología de *H. medinae*, consideramos pertinente ubicarla dentro de la categoría de datos insuficientes (DD por sus siglas en inglés) de la IUCN (2001).

Etimología. El epíteto específico está dedicado a la bióloga Rosalinda Medina Lemos, botánica entusiasta cuyo desempeño en el trabajo de campo, la investigación y la labor editorial han redituado en el mejor conocimiento no sólo de la flora del Valle de Tehuacán-Cuicatlán sino de México.

A continuación se presenta una clave para la determinación de las especies *Habranthus* de México.

Clave de las Especies de *Habranthus* en México

1a. Hierbas con flores blancas 2
  2a. Flores horizontales; tubo del perigonio mayor a 5 mm largo . . . . *H. immaculatus* Traub & Clint
  2b. Flores suberectas; tubo del perigonio menor a 5 mm largo 3

3a. Escapo 10–40 cm largo; flores con tintes verdosos o rosados . . . . *H. concolor* Lindley
3b. Escapo 2.0–5.5 cm largo; flores con venas rosadas a rojizas, rara vez completamente rosadas . . . . . *H. mexicanus* T. M. Howard

1b. Hierbas con flores amarillas o rosadas a magentas. . 4
4a. Flores amarillas, erectas a suberectas 5
5a. Plantas coetáneas; flores con mácula pardo-rojiza; sur de Puebla. . . . . *H. medinae* L. O. Alvarado & García-Mendoza
5b. Plantas histerantas; flores sin mácula; México (Coahuila y Nuevo León) y E.U.A. (Laredo, Texas). . . . . *H. howardii* (Traub) T. M. Howard
4b. Flores rosadas a magentas, declinadas a horizontales 6
6a. Hojas ca. 2 cm largo; escapo 30–65 cm largo; tubo del perigonio 5.0–8.0 mm largo . . . . . *H. oaxacanus* T. M. Howard
6b. Hojas 18–25 cm largo; escapo 17–21 cm largo; tubo del perigonio 10–15 mm largo . . . . . *H. vittatus* T. M. Howard

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Polystichum manickamianum (Dryopteridaceae), a New Species from South India

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ABSTRACT. A new pteridophyte species, *Polystichum manickamianum* Benniamin, Fraser-Jenkins & Irudayaraj, is described and illustrated from the Agasthiar Hills, South Western Ghats, South India. It is a member of *Polystichum* Roth sect. *Macropolystichum* Daigobo (Dryopteridaceae) and is distinguished from its nearest relatives by its relatively short, wide fronds with large, ovate-rhombic, crenate, dark green pinnules with submarginal sori, sparsely hairy upper stipe, rachis, and costae, and by the absence of subapical proliferous bulbils on the rachis. It is endemic to Tamil Nadu, South India, and is considered to be Critically Endangered (CR) based on IUCN Red List criteria. A key is provided to South Indian *Polystichum*, and some problematic related names are discussed. A lectotype is designated for *Aspidium tacticopterum* Kunze. *Polystichum kunthianum* B. K. Nayar & Geevarghese is newly synonymized into *P. subinerme* (Kunze) Fraser-Jenkins.

Key words: Agasthiar Hills, Dryopteridaceae, IUCN Red List, sect. *Macropolystichum*, *Polystichum*, pteridophyte, South India.

The genus *Polystichum* Roth (Dryopteridaceae) contains about 250 or more species in Asia (Fraser-Jenkins, 1991, 1997), with 46 species known from India and the introduction of a 47th here. Although the sections of the genus present in South India are also represented in the Indo-Himalayan region, only three species are found in both of these phytogeographical regions—*P. piceopaleaceum* Tagawa, *P. mucronifolium* (Blume) C. Presl (sect. *Metapolystichum* Tagawa), and *P. squarrosum* (D. Don) Fée (section *Duropolystichum* Fraser-Jenkins)—and the first and last species mentioned have a slightly different range of morphological variation between the north and south. A further four species are known to be present in South India, occurring in the Western and Eastern Ghats, namely: *P. harpophyllum* (Zenker ex Kunze) Sledge (sect. *Polystichum*), the very rare *P. anomalum* (Hooker & Arnott) J. Smith (forma *travancoricum* (Beddome) Fraser-Jenkins), *P. subinerme* (Kunze) Fraser-Jenkins, and *P. palniense* Fraser-Jenkins (Fraser-Jenkins, 2008b) (sect. *Macropolystichum* Daigobo). Accounts of most of the South Indian species have been given by Manickam and Irudayaraj (1992, 2003), although the names used there have been revised and further details given by Fraser-Jenkins (1991, 1997). *Polystichum walkerae* (Hooker) Sledge, *P. harpophyllum*, *P. biaristatum* (Blume) T. Moore (sect. *Macropolystichum*), *P. anomalum*, *P. mucronifolium*, and *P. piceopaleaceum* are present in adjacent Sri Lanka.

Of two problematic South Indian *Polystichum* names that could apply to the new species, the first, *P. tacticopterum* (Kunze) T. Moore, described from the Nilgiri Hills, was utilized by Sledge (1973) and some subsequent authors to refer to *P. mucronifolium* until revised by Fraser-Jenkins (1991). Apart from the lectotype designated below, no other possible type of Kunze's appears to exist in B, BM, JE, K, LZ, TUB, W, or other herbaria, and many of the Rev. B. Schmid's collections from Ootacamund were destroyed in 1944 in Kunze's main herbarium by British bombing in Leipzig during World War II. Kunze mentioned that he had only seen a single, but distinctive frond. In his careful and detailed description, he mentioned it as having a coriaceous indusium, which immediately appears to preclude *P. mucronifolium* and previously led Fraser-Jenkins in June 1990 to doubt whether the

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lectotype below represented the correct species. However, from Kunze's original description of only a slightly coriaceous, wide (12.5 × 5 in.), truncate-based lamina; approximate pinnae; minute, truncate, trapezoid-ovate pinnules that are minutely rusty-scaly beneath and have large, adpressed, aristate-serrate teeth and crenations; and the rachis with very large, biformed, rusty scales (but an incomplete stipe), *Aspidium tacticopterum* Kunze appears most likely to refer to the fairly common Nilgiri species, *P. mucronifolium*, a name mentioned only tentatively and adjacent to it by Kunze. Difficulty is only caused by its apparently differing significantly in having a coriaceous, brown indusium, whereas that of *P. mucronifolium* is diagnostically very thin and usually vestigial to absent. However, the very large rachis-scales are highly diagnostic for *P. mucronifolium*, and all other features agree well with it as opposed to all other South Indian *Polystichum* species. The species is therefore lectotypified here from the specimen suggested by Sledge (1973), with the name apparently written by Kunze, although Alston annotated it as being by Reichenbach and stated on it, "S. India: Nilgiris, Schmid 28 (type)." It is assumed here, as by Fraser-Jenkins (1991: 276), that Kunze's description of the indusium must, unusually, have been due to some confusion, rather than its being as variable in this species as suggested by Sledge.

Polystichum mucronifolium (Blume) C. Presl, Abh. Königl. Böhm. Ges. Wiss., ser. 5, 6: 415. 1849 [1851]. Basionym: *Aspidium mucronifolium* Blume, Enum. Pl. Javae 2: 164. 1828. TYPE: Java. *Blume s.n.* (holotype, L).

Aspidium tacticopterum Kunze, Linnaea 24: 210. 1851. *Polystichum tacticopterum* (Kunze) T. Moore, Index Filic. 105. 1858. TYPE: India. "India orientalis," s.d., s. coll., s.n. (lectotype, designated here, W [Hb. C. Koch, Hb. Musei Palat. Vindob.]).

The second name requiring study is *Polystichum moluccense* (Blume) T. Moore, which was first put forward tentatively by Fraser-Jenkins (1991) as the identity of the species now called *P. palniense* Fraser-Jenkins (Fraser-Jenkins, 2008b). *Polystichum palniense* is indeed closely related to *P. moluccense*, but is not conspecific, differing in having less finely lobed pinnules and in not having the abundant narrow fibrillose scales on the axes of the latter. The South Indian plant was then reidentified as being *P. kunthianum* B. K. Nayar & Geevarghese (Nayar & Geevarghese, 1993) by Fraser-Jenkins (1997: 209), on the basis of material of *P. palniense* mistakenly sent to him as authentic for *P. kunthianum* by Geevarghese in 1981. But on recently studying the immature, barely fertile holotype and isotype of *P. kunthianum*, it turns out that this was a further misidentification as the types are not *P. palniense*, but a poor specimen of *P. subinerme*, with more rhombic, less long-acute pinnules, submarginal sori, and extended frond apices as is the condition in the proliferous *P. subinerme*. It is too juvenile a plant to have developed subapical proliferous bulbils, although some narrowed pinna bases shortly below the apex are suggestive that it would have developed bulbils at those points had it matured further. *Polystichum subinerme* is present at Silent Valley, and thus *P. kunthianum* is reduced here to the synonymy of *P. subinerme* and *P. moluccense* is clarified as a name misapplied to *P. palniense* and not present in either India or Sri Lanka.

Polystichum subinerme (Kunze) Fraser-Jenkins, Aspects Pl. Sci. 13: 265. 1991. TYPE: India. Nilgiris, s.d., *Kurr s.n.* (holotype, K). Figure 1.

Polystichum kunthianum B. K. Nayar & Geevarghese, Fern Fl. Malab.: 214–216. 1993. Syn. nov. TYPE: India. Walakkad Forest, Silent Valley, West Nilgiri Hills, s.d., *K. [K. Geevarghese] 10661* (holotype, CALI; isotype, CALI).

The southernmost section of the Western Ghats, often known as the Southern Ghats, which lie in Tamil Nadu state, is an unusually rich floristic area with a high concentration of endemic plants (Henry et al., 1984; Ahmedullah & Nayar, 1987), more so than other comparable areas in South India. They have also been less well collected than higher parts of the Western Ghats until more recently by Father Manickam. The Tirunelveli Hills, which include the Agasthiar Hills, are one of the so-called hot spots of biodiversity in the Indian flora (Davis et al., 1995; Nayar, 1996). The presence of an undescribed species there is therefore not as unexpected as it might be in other better-known areas of the Western Ghats.

After publication of preliminary pteridophyte floras of the Western Ghats and Nilgiri Hills based on their new collections (Manickam & Irudayaraj, 1992, 2003), further revision of a number of pteridophytes has become necessary from time to time. Thus, one of Father Manickam's collections from the Agasthiar Hills, which had previously been listed under *Polystichum subinerme*, appeared distinctly different in its frond morphology and was preliminarily recognized by Manickam and Irudayaraj (2003) as an unnamed variation of the species. This is now recognized, below, as a distinct new species.

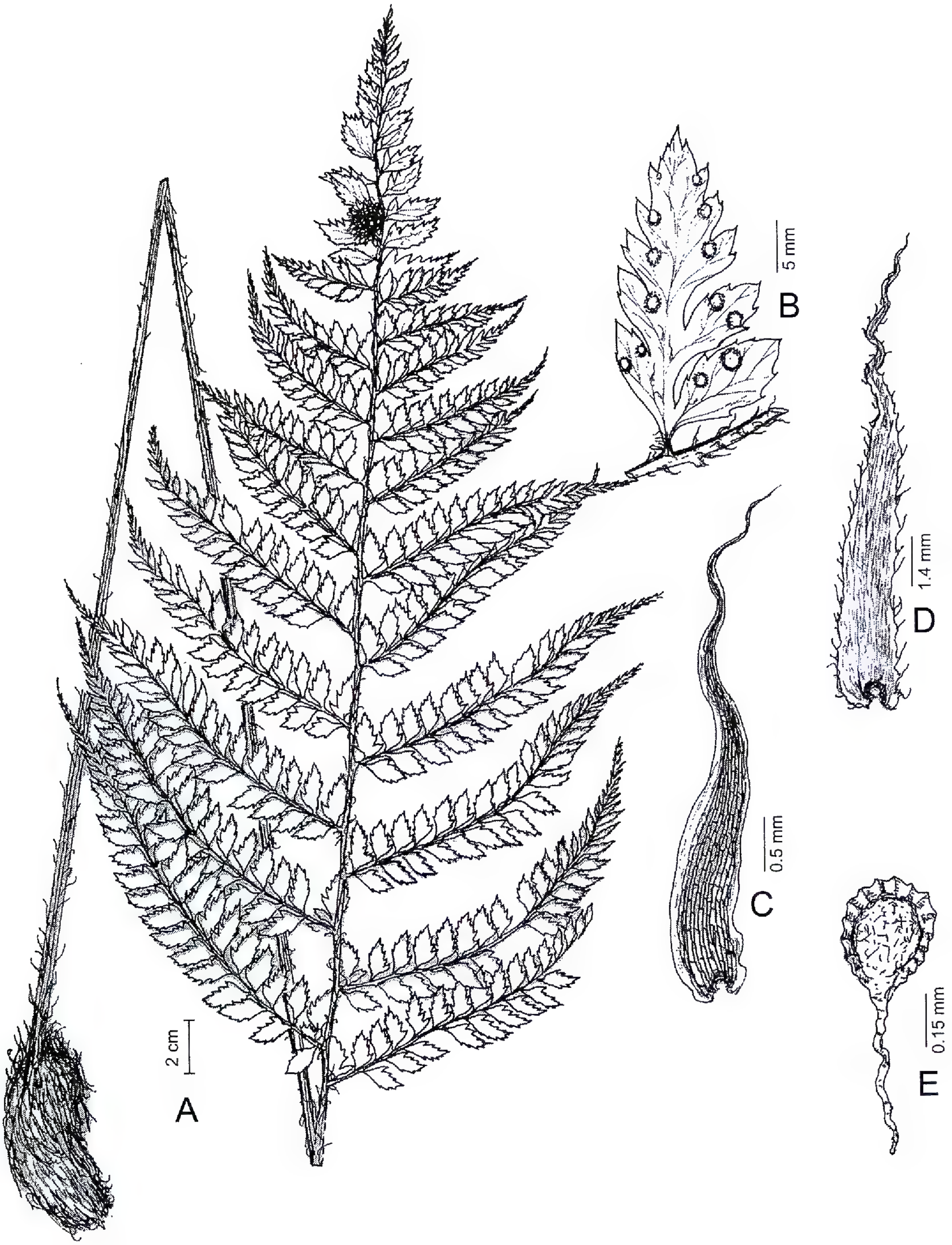

Figure 1. *Polystichum subinerme* (Kunze) Fraser-Jenkins. —A. Habit. —B. Lower median pinnule. —C. Stipe base scale. —D. Middle stipe scale. —E. Sporangium. Drawn from *V. S. Manickam XCH 1433* at XCH (India. Tamil Nadu: Nilgiri Dist., Kotagiri taluk, Kodanadu Valley shola [wood], 1800 m, 12 Feb. 1992).

Polystichum manickamianum Benniamin, Fraser-Jenkins & Irudayaraj, sp. nov. TYPE: India. Tamil Nadu: Tirunelveli Dist., Ambasamudram taluk, Kannikkatty Hills, Sangumuthirai (just below Agasthiar hilltop), stream banks, fully shaded, forest interior, 1500 m, 9 Apr. 1985, *V. S. Manickam RHT 32403* (holotype, RHT; isotypes, MH, XCH). Figure 2.

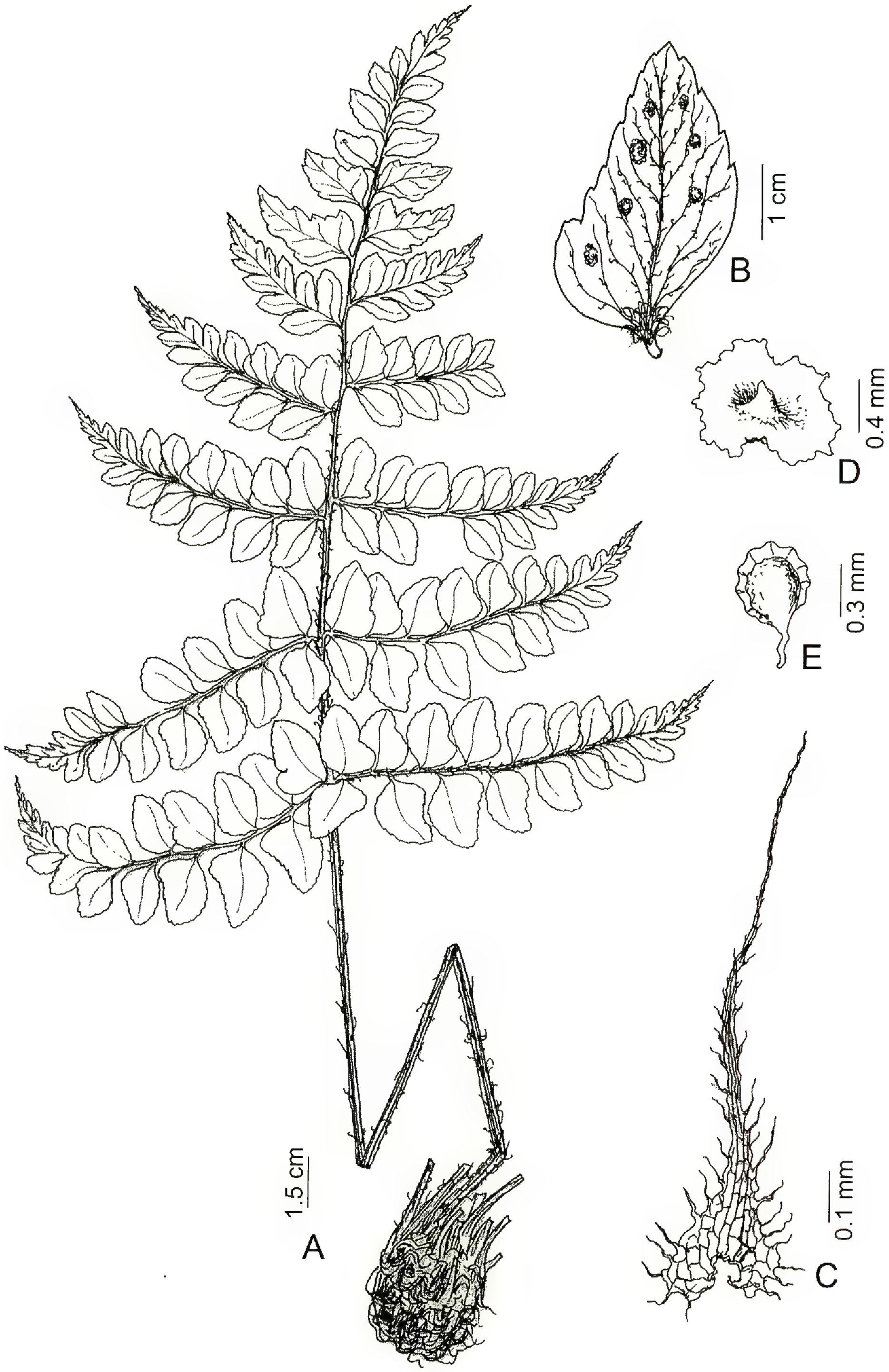

Figure 2. *Polystichum manickamianum* Benniamin, Fraser-Jenkins & Irudayaraj. —A. Habit. —B. Lower median pinnule. —C. Stipe base scale. —D. Indusium. —E. Sporangium. Drawn from the isotype, *Manickam RHT 32403* (XCH).

Species bene distincta; *Polysticho scarioso* (Roxburgh) C. V. Morton et *P. subinermi* (Kunze) Fraser-Jenkins affinis, sed rhizomate breve, erecto, stipite sparse paleaceo, paleis superioribus linearibus rufo- vel atro-brunneis, fronde brevi latissime deltata, segmentis magnis ovato-rhombiformibus crenato-dentatis, soris submarginalibus distinguitur.

Rhizome short, erect, ca. 8 cm thick, densely scaly at its apex. Fronds to 60 cm tall, arising in a tuft or crown-like arrangement, erecto-patent; stipe ca. 30 cm long, densely scaly only at its base, sparsely so above, scales lanceolate, dark reddish brown with a

scarious margin, fimbriate edges, and attenuated, acute apices, becoming linear or hair-like above; rachis and costae bearing scattered, pale brown hair-like fibrils; lamina ca. 30 × 20 cm, bipinnate, but rather abruptly becoming pinnate as it suddenly narrows toward the apex, deltate-lanceolate and widest from the middle to base, stiff-coriaceous, dark green adaxially when alive; pinnae ca. 5 to 12 pairs, the largest ca. 10 × 2 cm, borne at right angles to the rachis, elongated-rectangular, abruptly narrowing to acute apices, the lowest acroscopic pinnule sometimes enlarged and more lobed, pinnate; pinnules ca. 10 to 14 pairs, markedly stipitate with stalks ca. 0.2 cm, large, ca. 1 × 0.5–0.75 cm, the basal acroscopic pinnule of each pinna sometimes enlarged and deeply lobed, the rest ovate-rhombic, with ± obtusely narrowed apices, or the pinnule sometimes ± square with rounded corners in outline, markedly asymmetrical, the acroscopic base enlarged into a wide, rounded auricle, crenate at the edges, with a single acuminate, cartilaginous tooth at the apex; sori rather few and well apart, in 2 submarginal lines on each side of the pinnule, indusiate; indusium brown, thin, shrivelling and partly dropping off on ripening; spores non-abortive, rather large, ca. 45–48 µm, regular in size, dark brown, perisporiate with short rounded folds of perispore.

Distribution and habitat. Despite *Polystichum manickamianum* being known only from three collections from one locality on a single hilltop, this species is nevertheless so distinct that we have no hesitation in recognizing it as a new species.

It is presumed to be a species of Southeast Asian affinity, in keeping with most of the species of *Polystichum* sect. *Macropolystichum*. It is probably most closely related to *P. subinerme* and *P. scariosum*. Many other South Indian endemic ferns are of Southeast Asian affinity and, in some cases, have been found to be pseudo-endemics, already known from Southeast Asia, or otherwise the Himalayan region or tropical Africa (Fraser-Jenkins, 2008a).

Relationships and taxonomy. Polystichum subinerme is a very large, long-fronded species with many pinnae, bearing small, rounded-rhombic to acute-apexed pinnules with submarginal sori. The stipe is densely covered with pinkish brown, often widely lanceolate scales and the attenuated frond apex bears two to four scaly, subapical proliferous bulbils in the axils of the small upper pinnae, which are often missing a basal acroscopic lobe where the bud is borne. Although often reported from Southeast and East Asia in error, mainly for *P. scariosum*, it is a very rare species (with the potential IUCN status of Critically Endangered [CR], assessed by Chandra et al., 2008) that is confined as a South Indian endemic species to the Nilgiri Hills (Western Ghats) and Shevaroy [Servarayan] Hills (Eastern Ghats). In both areas, it is rare and decreasing with the increasing destruction of the forest cover by fire and cutting, and Chandra et al. (2008) have identified both *P. subinerme* and the new species *P. manickamianum* as two of 13 special Indian endemic target species for cases to be made for inclusion in the IUCN Red List (IUCN, 2001) as Critically Endangered (CR) species for India. We correct here the erroneous citation of *P. subinerme* (including specimen nos. *XCH 1367* and *1433*, cited below), together with *P. palniense*, under the name *P. moluccense* by Manickam and Dominic Rajkumar (1999), which partly explains the apparent polymorphicity and different cytotypes they described.

On 28 February 1987, Fraser-Jenkins misidentified a specimen (*Manickam 32444*) shown to him by Father Manickam as being a small specimen of *Polystichum subinerme*. But on his seeing its photograph (in Manickam & Irudayaraj, 2003) and going to South India to see the whole collection as well as a living plant grown in the Tropical Botanic Garden, Thiruvananthapuram (Trivandrum), by Raju Antony, it became obvious that it was a distinct species previously unrecorded from India. It differs from *P. subinerme* (which is not known from the Agasthiar Hills) in being a much shorter-fronded species, with a thinner stipe, bearing only a few, scattered, darker reddish brown scales and a wider-based, relatively wider frond, with obviously larger segments. Significantly, it is also without subapical proliferous bulbils, unlike those in *P. subinerme*.

The new species is also related to *Polystichum scariosum*, found in Southeast Asia, east Indo-Himalayas, Burma/Myanmar, Thailand, and China, and is placed here in the same section (sect. *Macropolystichum*). However, *P. scariosum* is a large, long-fronded species and has the middle to upper pinnules on each pinna decurrent to the costa and hardly basally auriculate, not markedly stalked or stipitate as in *P. manickamianum*. It also has a subapical proliferous bulbil toward the tip of each frond, though not always present on all fronds.

On Fraser-Jenkins' further investigation of the various Southeast Asian and Chinese species of the section, the status of *Polystichum manickamianum* as a new species was confirmed. It is named in honor of its collector, Rev. Dr. V. S. Manickam (b. 1941), of St. Xavier's College, Palyamkottai (formerly at Trivandrum [Thiruvananthapuram] University and St. Joseph's College, Tiruchchirappalli), the well-known pteridologist and indefatigable botanical collector and teacher in South India.

Cytology. The paratype of *Polystichum manickamianum* (*RHT 32444*) has been investigated by Irudayaraj (Manickam & Irudayaraj, 1988, sub *P. subinerme*) and found to have $n = 82$ (82 bivalents in the spore mother cells) at meiosis. However, no mitotic count has been carried out to ascertain whether it is a sexual tetraploid or an apomictic diploid species. Unfortunately, most of the spores have been shed in the material collected, and no further information is available as to the number of spores in the sporangia, which would also cast light on its mode of reproduction.

Polystichum subinerme from the Nilgiri Hills (Droog to Pathirakaliamman Koil path, 1700 m, *V. S. Manickam XCH 1367*) also had 82 bivalents at meiosis, but so far no mitotic count has been carried out. However, Benniamin has subsequently found that the above specimen only has ca. 7% normal sporangia containing 32 normal spores, the rest producing abortive spores. The percentage of normal sporangia he reports here is surprisingly low compared to many known apomicts, but this nevertheless suggests that the taxon may perhaps be an apomictic diploid ($n = 2n = 82$), although further study and the possibility of hybridity need to be considered. The spores of *P. subinerme* from the Shevaroy Hills are reported here by Fraser-Jenkins to be mostly fully formed (cultivated at the Botanical Garden, Yercaud, from Shevaroy Temple hill, near Yercaud, 5 Feb. 2007, *C. R. Fraser-Jenkins s.n.*, TAIF). The sample contains predominantly nonabortive, rather large spores, with a surface ornamentation of many small papilla-like wings of perispore, but occasional giant, spherical spores are also present.

Unfortunately, much confusion prevails concerning the cytotype of *Polystichum subinerme* and *P. palniense*, as both have been confused and misidentified taxonomically and variously reported as diploid and tetraploid. *Polystichum subinerme* was reported as $n = 82$ and interpreted as tetraploid by Ghatak (1977: 107) sub *P. biaristatum* (Blume) T. Moore s.l. from the Shevaroy Temple, Shevaroy Hills (voucher *G 251* in K), although this could also have referred to a diploid apomict as no mitotic count was done; it is reported herein as $n = 82$, perhaps diploid apomict. Probable *P. palniense* was reported as $n = 82$ by Manickam and Irudayaraj (1992: 269) sub *P. moluccense*, but without locality or number; however, *P. palniense* (voucher from Bear Shola Falls, Kodaikanal, *S. M. Vasudeva 1145* in PUN, reidentified by Fraser-Jenkins) was previously reported as $n = 41$, diploid sexual, by Bir and Vasudeva (1979: 223) sub *Arachniodes aristata* (G. Forster) Tindale. Manickam and Dominic Rajkumar (1999), who also included *P. subinerme* in their concept of *P. moluccense*, concluded that the latter probably contained two cytotypes, but most of the specimens they cited with ploidy were assumptions based on spore size, with no actual diploid counts. One of their cited specimens (*XCH 1433*) is *P. subinerme*, while another was assumed to be a hybrid partly on the spurious basis of irregular pinnule lobing. Manickam (1986) had previously listed four morphological and spore-fertility entities in this group of species, but their identity was not made clear. It is thus impossible at present to extrapolate the cytotype of either *P. subinerme* or *P. palniense* definitively.

Paratypes. INDIA. **Tamil Nadu:** Tirunelveli Dist., Ambasamudram taluk, Agasthiar Hills, Peak Shola [wood], forest floor, 1500 m, 10 Apr. 1985, *V. S. Manickam RHT 32444* (MO, RHT, XCH); Ambasamudram taluk, Kannikkatty Hills, forest at top of Agasthiar Hills, 1500 m, 9 Apr. 1985, *V. S. Manickam RHT 32386* (RHT).

Key to South Indian *Polystichum* Species

1a. Fronds simply pinnate . . . . . *P. harpophyllum*
1b. Fronds bipinnate 2
2a. Subapical proliferous bulbils present. . . . . *P. subinerme*
2b. Proliferous bulbils absent 3
3a. Stipe-base scales predominantly yellowish or reddish brown. 4
3b. Stipe-base scales predominantly blackish with pale edges 7
4a. Lamina nearly as wide as long . . . *P. manickamianum*
4b. Lamina much longer than wide. 5
5a. Stipe and rachis densely covered with broadly lanceolate to lanceolate, russet-brown scales, some at the base with dark red central bases . . . *P. squarrosum*
5b. Scales of upper stipe and rachis smaller and not broadly ovate, russet-brown, brown, or dark brown, the basal ones with darker, but not red central bases . . .6
6a. Pinnules obtuse with short-rhombic apices; stipe base without raised scars where the scales are attached; scales mostly pinkish brown . . *P. anomalum*
6b. Pinnules acute with long-acute apices; stipe base with raised scar-ridges where the scales are attached; scales yellowish brown . . . . . *P. palniense*
7a. Middle pinnules of the pinnae markedly basally auriculate and rhombic; rachis with small narrow scales; indusia prominent and thick . . *P. piceopaleaceum*
7b. Middle pinnules of the pinnae nonauriculate, falcate or slightly S-shaped; rachis with tufts of large broad scales at junctions with pinnae; indusia vestigial, very small, thin, or absent . . . . . *P. mucronifolium*

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A New *Juncus* Sect. *Ozophyllum* (Juncaceae) from Peninsular Florida, U.S.A.

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Abstract. *Juncus paludosus* E. L. Bridges & Orzell is described and illustrated as a new species from peninsular Florida, U.S.A., occurring primarily in hardwood and cypress swamps and adjacent ditches and marshes. Although closest in diagnostic characters to *J. megacephalus* M. A. Curtis, it has been confused with *J. polycephalus* Michaux of section *Iridifolii* Snogerup & Kirschner based on its overall size, gross morphology, and floral characteristics. Differences between *J. paludosus* and other closely related species of section *Ozophyllum* Dumortier are discussed, and a key is provided to the group within section *Ozophyllum* that includes *J. paludosus*.

Key words: Florida, Juncaceae, *Juncus*, *Ozophyllum*.

The genus *Juncus* L. is of almost worldwide distribution and contains about 300 species, with 95 species occurring in North America (Brooks & Clemants, 2000; Kirschner, 2002). Within Florida, the genus is represented by 21 species (Wunderlin & Hansen, 2003), 13 of which are found in central Florida (Wunderlin, 1982). Most of the *Juncus* species of the southeastern U.S.A. are clearly differentiated and not particularly difficult to identify in contrast with the more complex *Juncus* taxonomy of northern climates. Therefore, it was a surprise to the senior author to uncover—in the course of his work on the *Flora of Florida* (Wunderlin et al., 1996; Wunderlin & Hansen, 2008)—a large number of *Juncus* specimens from peninsular Florida. The specimens, which were mostly labeled as *J. polycephalus* Michaux, could not be accommodated within the species concepts of any known Florida species. At first, the author suspected a hybrid origin, perhaps between *J. polycephalus* and *J. megacephalus* M. A. Curtis. Both of these have been reported as growing intermixed in Florida (Godfrey & Wooten, 1979), and the uncovered specimens at first appeared to have some characters of each taxon. However, subsequent collecting at numerous sites, coupled with detailed study of the variations present within populations, revealed unique characters not present in either of the above species.

Juncus paludosus E. L. Bridges & Orzell, sp. nov. TYPE: U.S.A. Florida: Highlands Co., moist, sandy stream banks & adjacent overflow ditch on S side of Morgan Hole Creek bridge at Kissimmee Rd., Avon Park Air Force Range, 15 May 2003, *S. L. Orzell 26085* (holotype, USF; isotypes, BRIT, FLAS, FSU, GA, MO, NCU, NY, TEX, US). Figure 1.

Junco megacephalo M. A. Curtis affinis, sed differt culmis 4–8 mm diam. plus quam 80–150 cm altis, foliis amplissimis 3–7(–8) mm diam., (24–)40–80(–108) cm longis, cataphyllis et vaginis foliorum caulinorum tepalisque pigmento roseo-purpureo carentibus, et inflorescentia ex capitulis plus quam 25 composita.

Robust perennial, from short, hard, knotty rhizomes, forming small clumps; culms erect, stiff, terete, 80–150 cm, 4–8 mm diam. near the base, smooth. Cataphylls 1 to 3, straw-colored to dark brown, apex rounded; basal leaves 1 or 2 per culm, cauline leaves 2 to 4 per culm; basal leaf sheaths reddish purple at base, noticeably expanded, with a central spherical septate zone and broad membranaceous margins, all other leaf sheaths and blades green; leaf blades terete, septae drying prominently nodose-septate; leaf sheath with a prominent membranaceous, short, auriculate ligule, 1–3 mm; largest leaves (24–)40–80(–108) cm, 3–7(–8) mm diam., straight, not arcuate. Inflorescence an erect to slightly spreading, terminal, many-branched cyme, from (10–)15–25 cm, primary branches usually ascending at angles of 25°–50°, with (15 to)25 to 55(to 80) heads per inflorescence. Heads 20- to 60-flowered, spherical, 8–12 mm diam., at maturity reddish brown or brown. Tepals 6, 3.0–4.0 mm, lanceolate-subulate, tapering to a stiff acuminate reddish brown tip,

Figure 1. *Juncus paludosus* E. L. Bridges & Orzell. —A. Base of plant. —B. Inflorescence. —C. Perianth and capsule. —D. Seed.

subequal, at anthesis with a green zone on each side of the pale midrib and a hyaline margin, becoming straw-colored to yellowish brown at maturity. Capsule lanceolate to subulate, light yellowish brown, 4–5 mm, tapering gradually to the long subulate beak, the beak exserted from the tepals at maturity, the valves remaining attached at the beak after dehiscence, capsule 1-locular, fertile throughout or only near the base; seeds ellipsoid to ovoid, 0.3–0.5 mm, finely reticulate, with prominent longitudinal ridges and much finer cross-striations, the seed body clear yellowish brown, abruptly tapered at each end to short dark brown tips, not tailed.

Distribution and habitat. *Juncus paludosus* occurs nearly throughout peninsular Florida south to Monroe and Broward counties, north to Nassau County, and west near the coast to Franklin County in the eastern Florida Panhandle. It is common in forested wetlands (hardwood swamps, cypress swamps, and hydric hardwood-palm hammocks) and occasionally in roadside ditches and freshwater marshes adjacent to these habitats. While *J. paludosus* seems to favor seasonally flowing water and cypress-dominated strand swamps or sloughs, it is noticeably absent from still-water, cypress dome depressions. The lack of collections from the Florida Everglades region is likely explained by the absence of acidic forested wetlands, in contrast to the Big Cypress region of southwestern Florida, where such habitats are prevalent and *J. paludosus* has been collected. *Juncus paludosus* is apparently endemic to Florida. The authors have not seen or collected any specimens from outside of Florida, although it is expected in adjacent southeast Georgia.

IUCN Red List category. Our preliminary conservation assessment is based on the abundance, distribution, and habitat preference of *Juncus paludosus*. We recommend that *J. paludosus* be classified as a taxon of Least Concern (LC) as set forth in the IUCN Red List Categories and Criteria (IUCN, 2001). *Juncus paludosus* is widespread and is currently known from 29 Florida counties. It is often locally abundant and displays considerable habitat breadth, occurring in both natural and human-altered (roadside ditches, drainageways, etc.) wetlands.

Phenology. In south and south-central Florida, *Juncus paludosus* typically reaches anthesis from April to May between the winter dry season and the onset of the summer wet season. Mature capsules can be found from May to July, but fruiting is somewhat sensitive to changes in El Niño-Southern Oscillation (ENSO) since ENSO influences winter and spring rainfall in peninsular Florida (Beckage et al., 2003). During the La Niña phase of ENSO, the dry conditions make it more difficult to locate fruiting plants, and capsules may abort or fail to reach maturity.

Relationships. *Juncus paludosus*, a species of section *Ozophyllum* Dumortier, has flowers borne in heads and leaves that are terete and completely septate. It is therefore notable that many south Florida specimens (Austin et al., 1990; Huffman & Judd, 1998; Muss et al., 2003) have been previously identified as *J. polycephalus*. *Juncus polycephalus* is a member of section *Iridifolii* Snogerup & Kirschner, a group characterized by flattened leaves with incomplete septae. In general inflorescence morphology, *J. paludosus* does resemble *J. polycephalus*, and many floral and fruit characters are similar between the two species. However, *J. polycephalus* has laterally

flattened, slightly arcuate, incompletely septate leaf blades and lacks a membranaceous ligule at the apex of the leaf sheath. In contrast, *J. paludosus* has terete, stiff and straight, strongly completely septate leaf blades and a prominent 1–3 mm long membranaceous auriculate ligule. In fact, the leaf blades of *J. paludosus* are among the most strongly nodose-septate in the genus, with the septae evident on dried leaves as hardened, ring-like bands. In central Florida and northward, both species are known to occur, although there are very few specimens of *J. polycephalus* south of Gainesville, Florida. This is reflected in the distribution map in Brooks and Clemants (2000), with the dot in peninsular Florida representing a Polk County record.

Within section *Ozophyllum*, *Juncus paludosus* falls within a small group having many-flowered spherical heads, capsules exserted beyond the perianth, and seeds without membranaceous tails. This group consists of *J. validus* Coville, *J. nodatus* Coville, *J. scirpoides* Lamarck, and *J. megacephalus*. *Juncus validus* has leaves that are often laterally compressed (as in *J. polycephalus*) but with complete septae. It further differs from *J. paludosus* in its widely spreading, relatively few-headed inflorescence, lack of basal cataphylls, and capsules with valves usually separating at dehiscence. *Juncus nodatus*, a much smaller plant of northern and western North America, does not occur in Florida. *Juncus scirpoides* is a smaller plant than *J. paludosus*, with shorter leaves and a more compact inflorescence of fewer heads, which are usually lobed rather than spherical.

The remaining species in this group, *Juncus megacephalus*, is perhaps the closest to *J. paludosus* in overall morphology, but with many important differences. It is typically a smaller-statured plant, rarely to 1 m tall, with culms 3–4 mm wide, leaf blades less than 25 cm long, and rather compact inflorescences, usually with fewer than 20 heads. *Juncus megacephalus* is suffused with more reddish purple pigment than *J. paludosus*, particularly in the cataphylls, leaf sheaths, and tepals. Live material of *J. megacephalus* is easily recognized by its deep wine-red lower leaf sheaths and cataphylls, the bluish cast of the culms and leaf blades, and dark reddish black flowering heads. In contrast, the prominent hues in *J. paludosus* are yellowish green and stramineous to light brown, with little reddish purple pigment.

Paratypes. U.S.A. **Florida**: Brevard Co., 27 Jan. 1992, *Grey s.n.* (USF), open roadside, US 192, 12 mi. W of Melbourne, *Baltzell 8053* (FLAS); Broward Co., Hwy. 441 W of Deerfield Beach, *Atwater #GS-42* (FLAS); Charlotte Co., dry cypress swamp, 7 May 1947, *Frye s.n.* (FLAS); Citrus Co., Withlacoochee River, *Hartman 72A* (FLAS), Woodward Park Inlet, Kings Bay, Crystal River, *Hartman 42* (FLAS); Collier Co., trailside swamp, Big Cypress, W of FL 29, *Lakela & Almeda 29960* (USF), Scenic Dr., vic. Fakahatchee, *Lakela & Almeda 30007, 30740* (USF), Everglades, along Rte. 94, 21 Apr. 1936, *McDaniel s.n.* (FSU), cypress swamp, bridge 121, 6 Apr. 1942, *Davis s.n.* (FLAS), ditch beside Janes Hwy., Fakahatchee Strand, *Avery & Churchill 2058* (FLAS), swamp forest E of Janes Mem. Scenic Dr., Fakahatchee Strand St. Pres., *Bridges 23510* (BRIT, FLAS, FSU, GA, NCU, NY, USF), *23511* (FLAS, USF); Dixie Co., 15 mi. NW of Cross City, *Kral & Redfearn 2677* (FSU); Duval Co., Jacksonville, *Curtiss 2981* (FLAS); Franklin Co., Apalachicola River, NW of Apalachicola, *Kral & Redfearn 2741* (FSU); Gilchrist Co., 4 mi. E of Trenton, 5 Oct. 1940, *West & Arnold s.n.* (FLAS); Hendry Co., Big Cypress Indian Reservation, 8 May 1961, *Jennings s.n.* (FLAS); Highlands Co., natural drainage E side of Morgan Hole Rd., Avon Park Air Force Range (hereafter APAFR), *Orzell 25278* (BRIT, FLAS, FSU, GA, NCU, NY, USF), *Orzell 25280* (BRIT, FLAS, FSU, GA, NCU, NY, USF), N side of Morgan Hole Creek bridge, APAFR, *Orzell 25281* (BRIT, FLAS, FSU, GA, NCU, NY, USF); Hillsborough Co., N of Tampa, *Crewz 1590, 1600* (USF), along Morris Bridge Rd., *Burch 6827* (USF), Morris bridge wellfield, 29 May 1985, *Lopez s.n.* (USF), bank of Cypress Creek, *Lakela 26057* (USF); Jefferson Co., ca. 4 mi. E of Newport, *Godfrey 75147* (FSU); Lee Co., swamp edges W of headwaters of Halfway Creek, ca. 1 air mi. NE of Coconut on Estero Bay, *Orzell & Bridges 19385* (FLAS, USF); Levy Co., both sides of FL 24 at E end of Waccasassa River bridge, *Cochrane 8883* (USF), N side of rd., Otter Creek, *Gunter & Horsburgh 45* (FLAS), 6 mi. W of Otter Creek, *Dunevitz 38* (FLAS); Manatee Co., along FL 70, 6 mi. E of the Braden River, 12 Mar. 1969, *Burgis s.n.* (FLAS); Monroe Co., FL Rte. 94, SE of Monroe Station, *Godfrey, Ward & Burch 63552* (FLAS, FSU); Nassau Co., vic. of O'Neil, *Godfrey 64113* (FSU); Orange Co., ca. 2.5 mi. N of FL 50 at Christmas, Orlando Wild. Park, *Orzell & Bridges 21681* (FLAS, FSU, USF), Tosohatchee St. Reserve, *Bridges 24520* (BRIT, FLAS, FSU, GA, NCU, NY, US, USF); Osceola Co., along US 192, 13.4 mi. SE of Holopaw, *Baltzell 8055* (FLAS), Crabgrass Creek, Bull Creek WMA, *Hall 567* (FLAS); Pasco Co., pond S of SR 54, *Genelle & Fleming 99* (USF), 9 June 1961, *Riegler s.n.* (USF); Pinellas Co., Brooker Creek Preserve, *Hansen, Wunderlin & Douris 12081* (USF); Polk Co., Hard Luck Hammock, APAFR, *Lindsey & Upchurch 778* (USF), N of Tick Island, APAFR, *Orzell 23713* (USF), Tick Island Slough, APAFR, *Orzell 25285* (FLAS, FSU, USF), SE of sewage disposal plant, APAFR, *Orzell 25287* (BRIT, FLAS, FSU, GA, NCU, NY, US, USF), 12 mi. NNW of Lakeland, *Kral 7282* (FLAS, FSU, USF); Putnam Co., Sweetwater Creek, *Martin & Cooper 624* (FLAS, FSU); Seminole Co., near Little Wekiva River, 2 mi. W of Altamonte Springs, *Baltzell 3924* (FLAS), Wekiva River at FL 46, *Myint 941* (FLAS); Sumter Co., 0.5 mi. W of Tarrytown, *Kral 6860* (FLAS, FSU, USF); Taylor Co., 4 mi. S of Salem, *Kral & Redfearn 2683* (FSU); Volusia Co., E side of Rte. 3, 24 May 1975, *Poppleton & Shuey s.n.* (USF), Maytown Rd., 1.9 mi. W of Cow Creek, *Robinson & Hansen 189* (USF); Wakulla Co., ca. 5.5 mi. WSW of Newport US 98 at bridge across Wakulla River, *Hansen & Richardson 5865* (USF), along US Hwy. 98, 1 mi. E of Newport, *Wiggins 20034* (FLAS).

The following key (modified from Brooks & Clemants, 2000) distinguishes *Juncus paludosus* from other members of section *Ozophyllum* (subgenus *Septati* Buchenau, as used in Brooks & Clemants,

2000) with three stamens, flowers borne in more or less spherical heads of usually more than 15 flowers, and without tailed seeds. This key should be inserted at couplet 16 in Brooks and Clemants (2000: 241). Of the species included in this key, only *J. acuminatus* Michaux, *J. scirpoides*, *J. megacephalus*, and *J. validus* var. *validus* are found within any part of the known range of *J. paludosus*.

SUPPLEMENTAL KEY TO PART OF *JUNCUS* SECTION *OZOPHYLLUM* (SUBGENUS *SEPTATI*, SENSU BROOKS & CLEMANTS, 2000) IN NORTH AMERICA

1a. Plants strictly caespitose, without any short, hard, knotty rhizomes; tepals lanceolate . . . . . *J. acuminatus* Michaux
1b. Plants with at least some short, hard, knotty rhizomes, but sometimes appearing nearly caespitose due to very short rhizome internodes; tepals lanceolate-subulate. 2
2a. Capsules shorter than the tepals, and clearly included within the tepals at maturity . . *J. brachycarpus* Engelmann
2b. Capsules equaling or exceeding the tepals, exserted from or only slightly included within the tepals at maturity . . . 3
3a. Capsule valves remaining united at the apex after dehiscence 4
4a. Leaves laterally compressed; heads 6- to 15-flowered . . . . . *J. validus* var. *fascinatus* M. C. Johnston
4b. Leaves strictly terete; heads 20- to 60-flowered 5
5a. Culms 4–8 mm in diam. near the base, usually more than 80 cm tall; inflorescence usually more than 15 cm tall, with more than 25 heads; largest leaf blades more than 25 cm long and 3 mm in diam. . . . . *J. paludosus* E. L. Bridges & Orzell
5b. Culms 1–3 mm in diam. near the base, usually less than 80 cm tall; inflorescence usually less than 10 cm tall, with less than 25 heads; largest leaf blades less than 25 cm long and 1–2 mm in diam. 6
6a. Heads usually at least somewhat lobed; tepals green to straw-colored, nearly equal in length; basal leaf sheaths and cataphylls straw-colored to brown . . . . . *J. scirpoides* Lamarck
6b. Heads strictly spherical; tepals ± reddish brown to purplish, the inner tepals somewhat shorter than the outer; basal leaf sheaths and cataphylls deep reddish purple . . . . . *J. megacephalus* M. A. Curtis
3b. Capsule valves separating at the apex during dehiscence 7
7a. Tepals 4–5 mm long; leaves laterally compressed. . . . . *J. validus* Coville var. *validus*
7b. Tepals 2.9–4.0 mm long; leaves terete 8
8a. Capsules 3.5–5.0 mm long, exserted; culms 0.4–3 dm tall. . . . . *J. nodosus* L.
8b. Capsules 3.0–3.5 mm long, equaling perianth or slightly included; culms 2.5–8.5 dm tall . . . . *J. bolanderi* Engelmann

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New Species, Varieties, and Combinations in *Cuphea* (Lythraceae) from Brazil

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Abstract. Six new species and two varieties of *Cuphea* P. Browne (Lythraceae) are described from Brazilian collections. *Cuphea lucens* T. B. Cavalcanti & S. A. Graham from Minas Gerais is described in sect. *Melvilla* Koehne subsect. *Pachycalyx* Koehne where it is similar to *C. cylindracea* S. A. Graham but lacks the prominently descending floral tube spur of that species. *Cuphea alatosperma* T. B. Cavalcanti & S. A. Graham from the Amazon, with inflated-winged seeds, and *C. anamariae* T. B. Cavalcanti & S. A. Graham, a novelty from white sands in Minas Gerais, belong to sect. *Euandra* Koehne subsections *Platypterus* Koehne and *Hilariella* Koehne, respectively. *Cuphea exilis* T. B. Cavalcanti & S. A. Graham, *C. filiformis* T. B. Cavalcanti & S. A. Graham, and *C. rupestris* T. B. Cavalcanti & S. A. Graham, new species with linear-lanceolate leaves and a woody xylopodium (not confirmed in *C. exilis*), are members of sect. *Euandra* subsect. *Oidemation* Koehne, as are the newly recognized variety *C. spermacoce* A. St.-Hilaire var. *arguta* T. B. Cavalcanti & S. A. Graham and the new combination *C. spermacoce* var. *erectifolia* (Koehne) T. B. Cavalcanti & S. A. Graham. Lectotypes are selected for *C. erectifolia* Koehne and two forms of the species. A key to the varieties of *C. spermacoce* is provided.

Resumo. Seis novas espécies e duas novas variedades de *Cuphea* P. Browne (Lythraceae) são descritas a partir de coleções brasileiras. *Cuphea lucens* T. B. Cavalcanti & S. A. Graham, de Minas Gerais, é descrita para a seção *Melvilla* Koehne subseção *Pachycalyx* Koehne onde é semelhante à *C. cylindracea* S. A. Graham, mas difere por não possuir o cálcar proeminentemente descendente como naquela espécie. *Cuphea alatosperma* T. B. Cavalcanti & S. A. Graham, da Amazônia, com sementes de ala inflada e *C. anamariae* T. B. Cavalcanti & S. A. Graham, uma novidade das serras de solos de areia branca de Minas Gerais, pertencente à seção *Euandra* Koehne subseção *Platypterus* Koehne e *Hilariella* Koehne, respectivamente. *Cuphea exilis* T. B. Cavalcanti & S. A. Graham, *C. filiformis* T. B. Cavalcanti & S. A. Graham e *C. rupestris* T. B. Cavalcanti & S. A. Graham, novas espécies com folhas linear-lanceoladas e xilopódio (não confirmado em *C. exilis*), são membros da seção *Euandra* subseção *Oidemation* Koehne, assim como a nova variedade reconhecida *C. spermacoce* A. St.-Hilaire var. *arguta* T. B. Cavalcanti & S. A. Graham e a nova combinação *C. spermacoce* var. *erectifolia* (Koehne) T. B. Cavalcanti & S. A. Graham. Lectótipos são selecionados para *C. erectifolia* Koehne e duas formas das espécies. Uma chave para as variedades de *C. spermacoce* é fornecida.

Key words: Brazil, *Cuphea*, IUCN Red List, Lythraceae.

New taxa are described here as part of a collaborative effort to revise the large (90+ species), primarily Brazilian section *Euandra* Koehne of the genus *Cuphea* P. Browne (Lythraceae), and to identify undetermined material of the genus in the herbaria of Empresa Brasileira de Pesquisa Agropecuária (Embrapa) Genetic Resources and Biotechnology (CEN) and the University of Brasília (UB). The study adds six new species and two varieties to other recent additions of *Cuphea* discovered in the Brazilian flora (Graham & Cavalcanti, 1999; Cavalcanti & Graham, 2005). *Cuphea alatosperma* T. B. Cavalcanti & S. A. Graham (sect. *Euandra* subsect. *Platypterus* Koehne) from the Amazon has seeds with unique inflated seed wings unlike any other seeds in the genus. *Cuphea anamariae* T. B. Cavalcanti & S. A. Graham (sect. *Euandra* subsect. *Hilariella* Koehne) is a new member of the white sands flora in the species-rich Serra do Espinhaço of Minas Gerais state. In sect. *Euandra* subsect. *Oidemation* Koehne, which includes *Cuphea*

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possessing a xylopodium, three new species and two varieties are named: *C. exilis* T. B. Cavalcanti & S. A. Graham, with tiny, glaucous gray-green, uninerved, appressed leaves, discovered in botanically poorly known southern Pará; *C. filiformis* T. B. Cavalcanti & S. A. Graham, a species from Goiás and the Distrito Federal, with long, linear, nearly bladeless leaves that is closely related to *C. spermacoce* A. St.-Hilaire; *C. rupestris* T. B. Cavalcanti & S. A. Graham, an herb with verticillate, linear leaves from Goiás; and *C. spermacoce* var. *arguta* T. B. Cavalcanti & S. A. Graham and *C. spermacoce* var. *erectifolia* (Koehne) T. B. Cavalcanti & S. A. Graham. *Cuphea spermacoce* var. *arguta* is based on plants with 3-verticillate, narrowly linear-lanceolate leaves with a sharply acute-acuminate apex. *Cuphea spermacoce* var. *erectifolia* is reduced from *C. erectifolia*, and *C. erectifolia* forma *angustifolia* Koehne and forma *latifolia* Koehne are new synonyms of *C. spermacoce* var. *erectifolia*. *Cuphea lucens* T. B. Cavalcanti & S. A. Graham, with yellow floral tubes, is described in sect. *Melvilla* Koehne subsect. *Pachycalyx* Koehne. The species is known only from the type collection from southern Minas Gerais. Collections cited below include in brackets the latitude/longitude position to the nearest locality if a specific geographical reference point is not part of the original collection data.

1. Cuphea alatosperma T. B. Cavalcanti & S. A. Graham, sp. nov. TYPE: Brazil. Amazonas: Km 21 da Rodov. Itacoatiára–Manáus, beira Rio Urubú, [3°08′S, 58°26′W], 8 Nov. 1963, *E. Oliveira 2909* (holotype, UB; isotypes, IAN photo at CEN, MO). Figure 1.

Ad sect. *Euandram* Koehne subsect. *Platypterum* Koehne pertinens. Species optime distincta tubo florali ampullaceo, 8–8.5 × 2.5–3.5 mm, erecto ad caulem parallelo, pedicellum subbasalem tenenti, etiam seminibus oblongo-obovatis marginibus alatis praeditis, alis seminum conspicuis inflatis, irregularibus, undulatis; caulibus semidecumbentibus, non ramosis; foliis ovato-ellipticis; petalis 6, subaequalibus, lilacinis; ovulis 16.

Perennial herbaceous subshrubs, ca. 40 cm tall, roots fibrous, stems lax, semi-decumbent, spreading, unbranched, red-brown, densely and minutely hispid to strigose, becoming more densely strigose toward stem apex, the trichomes white, eglandular, sharp-pointed; internodes equal to or longer than the subtending leaves. *Leaves* decussate, spreading to ascending, subsessile, petioles 1–2 mm; blades narrowly ovate-lanceolate to elliptic, 15–33 × 8–15 mm, membranous, base and apex acute, margin plane, slightly undulate; blade surfaces scabrous, the trichomes minute, white, strigose, midvein and secondary veins reddish brown; leaves scarcely to not at all reduced in size toward the stem apex. *Inflorescences* frondose, sparsely flowered, secund racemes; flowers interpetiolar, alternate; pedicels ca. 2 mm, persistent, attached subbasally; bracteoles suborbicular, leaf-like, 1–1.5 × 1.5–2 mm, at mid-point of pedicel. *Floral tubes* oriented at 45° to the stem or some erect and parallel to the stem, 8–8.5 × 2.5–3.5 mm at anthesis, base rounded, not spurred, neck contracted at 5–6 mm from the base, mouth ca. 3 mm diam. in lateral view, neither oblique nor flared, ampullaceous in fruit; outer surface of floral tube pale rose with darker veins, minutely white strigose-hispid as on stems, glandular setae infrequent on the veins; inner surface white, villous above the stamens, retrorsely villous along the veins below the 2 dorsal short stamens, the rest glabrous, vesicles 0; sepals equal, ca. 1 × 2 mm, broadly deltate, apex acute, margin not ciliated; epicalyx segments thickened calluses at the sinus of the sepals, shorter than the sepals, strigose, margin scarcely free; petals 6, subequal, 4–4.5 × ca. 0.5 mm, linear to linear-obovate, clear lilac, caducous, the 2 dorsal petals subtended by a thickened callus, callus free at the margin and extended briefly along the vein; stamens 11, included, 2 dorsalmost shortest and most deeply inserted, the others reaching the sinus of the sepals, densely white villous except the 3 ventral antesepalous stamens glabrous; pollen oval-triangular in polar view, tricolporate, syncolpate, pores strongly protruding, exine striated, striae not reaching the pores, some ca. parallel with the equator, grain diam. 20–22 µm; style included, becoming subexserted in fruit, glabrous; ovary glabrous; ovules 16; nectariferous disc thick, horizontal, slightly cupping ovary, shallowly 3-lobed in dorsal view. *Seeds* oblong to obovate with winged margin conspicuously inflated; seed body ca. 2 × 1.5 mm, narrowly brown-marginate; outer inflated margin paler, undulate, encircling the seed body, irregularly interrupted, 0.1–0.4 mm wide.

Distribution and ecology. Brazil. Amazonas; river and lake margins; 10–50 m.

IUCN Red List category. Although the precise conservation status of *Cuphea alatosperma* is undetermined, the species should be classified as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001) because the two localities where it has been found are likely to suffer increased disturbance with increasing travel along the roads outside of the large Amazonian city of Manaus and with tourism at Lago do Carauacu.

Phenology. Collected in bud, flower, and fruit in November and probably flowering from late October to February or March.

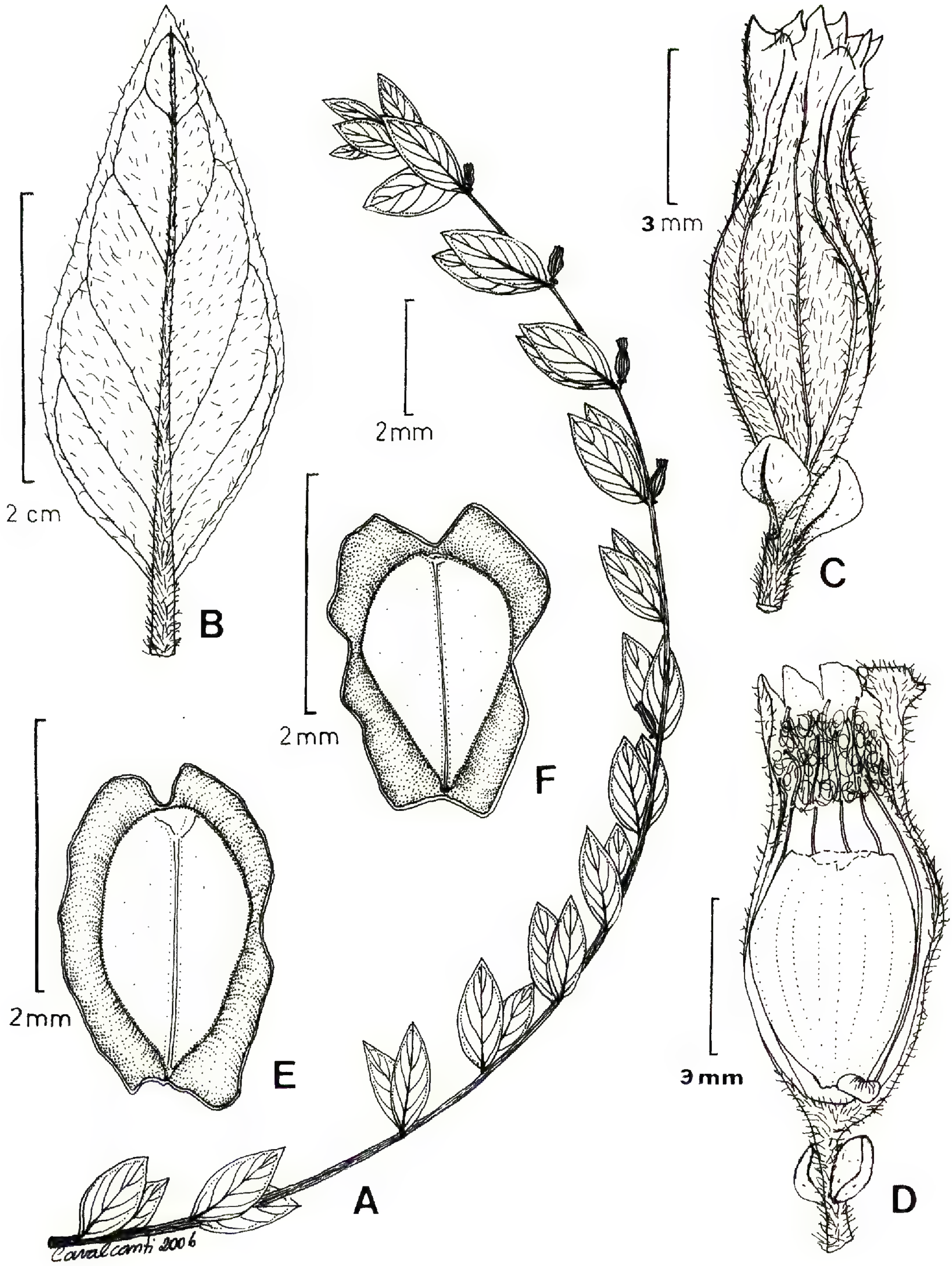

Figure 1. *Cuphea alatosperma* T. B. Cavalcanti & S. A. Graham. —A. Habit. —B. Leaf, abaxial surface. —C. Floral tube in fruiting stage. —D. Floral tube, opened longitudinally, ovary apex and style removed. —E, F. Seeds, adaxial view, illustrating variation in the enlarged marginal seed wing. Drawn from the holotype (*Oliveira 2909*, UB).

Relationships. The flowers of *Cuphea alatosperma* are some of the most distinctive of the genus due to the subbasal attachment of the pedicel, which causes the nearly regular flower to be held approximately erect. All other *Cuphea*, with the exception of a few species in sections *Archocuphea* Koehne and *Cuphea* that have much smaller (3–7 mm), more bilateral, oppositely arranged flowers, have pedicels attached ventrally and are displayed at a 45°–90° angle to the stem. Furthermore, the seeds of *C. alatosperma* are unique in the genus in having a puffy, undulating wing surrounding the seed body. The inflated margin is

morphologically, although not phylogenetically, intermediate between the true wings seen in seeds of other genera of the Lythraceae such as *Diplusodon* Pohl, *Galpinia* N. E. Brown, *Lafoensia* Vandelli, and *Physocalymma* Pohl and the basically wingless, bilaterally compressed seeds of other *Cuphea*.

The relationships of *Cuphea alatosperma* are unclear. The species, following Koehne's classification (1903), belongs to the highly polymorphic sect. *Euandra* subsect. *Platypterus*, but it is unlike any species of that group. The IAN isotype was annotated by A. Lourteig (undated) as probably new and near *C. chiquitensis* Herzog (= *C. sessiliflora* A. St.-Hilaire; Lourteig, 1986) in section *Pseudocircaea* Koehne, but *C. alatosperma* lacks the diagnostic characters of that section, i.e., petals of *C. alatosperma* are not persistent, pollen is not diporate, and glandular-viscous trichomes are absent. Viable pollen is 42% of total pollen based on a count of 200 pollen grains stained in lactophenol cotton blue (Sass, 1958; Kearns & Inouye, 1993). Additional collections of the species are a high priority, given the near basal attachment of the flower, a trait desired by plant breeders who are developing non-shattering lines of *Cuphea* for commercial seed-oil sources (Knapp & Crane, 2000).

Paratype. BRAZIL. **Amazonas**: Rio Amazonas, Lago Carauacu, black water lake margin, [4°18′S, 62°4′W], 2 Nov. 1986, *G. T. Prance 30114* (MO [2], NY not seen).

2. Cuphea anamariae T. B. Cavalcanti & S. A. Graham, sp. nov. TYPE: Brazil. Minas Gerais: Joaquim Felício, Serra do Cabral, campo arenoso em topo de morro, com trechos alagáveis e campo rupestre adjacente, 17°45′S, 44°10′W, 13 Mar. 1999, *V. C. Souza & J. P. Souza 22021* (holotype, CEN; isotypes, CEN, ESA, MO). Figure 2.

Ad sect. *Euandram* Koehne subsect. *Hilariellam* Koehne pertinens, sed foliis anguste lanceolatis, sessilibus (paucis falcatis), base rotundata et margine glandulari-viscosa, ciliata; floribus gracilibus, ca. 9 mm longis, calcari fortiter descendenti, introrsum omnino piloso, vesiculis nullis; ovulis 3; seminibus crassis, marginibus rotundatis et non distincte incrassatus distinguenda.

Perennial herbaceous subshrubs, ca. 35 cm tall, roots fibrous, stems erect, irregularly much branched, highly viscous and minutely glandular-hispid, the trichomes dense, translucent, erect; internodes mostly shorter than the subtending leaves. *Leaves* decussate, sessile; blades narrowly lanceolate tending to become falcate on distal branches, 10–35 × 3–10 mm, typically ca. 30 × 10 mm at midstem, distinctly smaller on the short secondary branches, chartaceous, base rounded, sometimes acute, apex acute, margin plane, younger leaves conspicuously ciliated by red glandular-viscous setae to 0.5 mm; blade surfaces minutely scabrous, appearing glabrous, with sparse red glandular setae as on the margin, prominent intramarginal vein visible on both surfaces; leaves gradually diminishing in size toward the apex of the stem. *Inflorescences* frondose, ± terminal racemes; flowers interpetiolar, alternate; pedicels 8–9 mm, attached ventrally, persistent; bracteoles ovate, to 1 × 0.5 mm, persistent at the apex of the pedicel. *Floral tubes* ca. 9 × 2 mm at anthesis including a distinctly descending, truncated spur 1–1.5 mm long, the tube enlarged basally, narrowed at the neck, mouth blunt, slightly upturned; outer surface wine-colored, sparsely glandular-hispid on the veins, mostly glabrous between veins, the trichomes 0.2–0.4 mm; inner surface pilose or pilose above the stamens and glabrous below them, vesicles 0; sepals equal, ca. 1.1 × 1 mm, deltate; epicalyx segments rounded thickenings, shorter than the sepals, ca. 0.5 mm, bearing 1 to a few short setae; petals 6, equal, ca. 4 × 2 mm, oblong-obovate, clear rose-colored, caducous; stamens 11, included, villous, 2 dorsalmost shortest and most deeply inserted, the others reaching the margin of the floral tube; pollen oval-triangular, tricolporate, syncolpate, pores strongly protruding, exine striate, grain diam. ca. 25 μm; style villous basally, included at anthesis; ovary glabrous; ovules 3; nectariferous disc ca. 0.8 × 0.6 mm, oblique, triangular in dorsal view. *Seeds* suborbicular to oblong, 2.1–2.2 × ca. 2 mm, thick, margin rounded, not distinctively rolled, thinned, or pale.

Distribution and ecology. Brazil. Minas Gerais; collected at the top of Serra do Cabral, a disjunct part of the extensive Serra do Espinhaço; in flooded areas of white sand; 700–1300 m.

IUCN Red List category. *Cuphea anamariae* is known only from the two cited specimens. The conservation status according to IUCN Red List criteria (IUCN, 2001) is estimated as Vulnerable (VU) on the basis of the restriction of the species to a disjunct section of the Serra do Espinhaço in very localized white sand habitats.

Phenology. Collected in flower and fruit in March, probably in flower from January to May.

Etymology. The species is named in honor of Ana Maria Giulietti-Harley (HUEFS), expert on the flora of the Serra do Espinhaço and friend and mentor of countless students of Brazilian botany.

Relationships. *Cuphea anamariae* is yet another novelty from the species-rich cerrado of the Serra do Espinhaço in Minas Gerais. The new species is distinguished by the unique character combination:

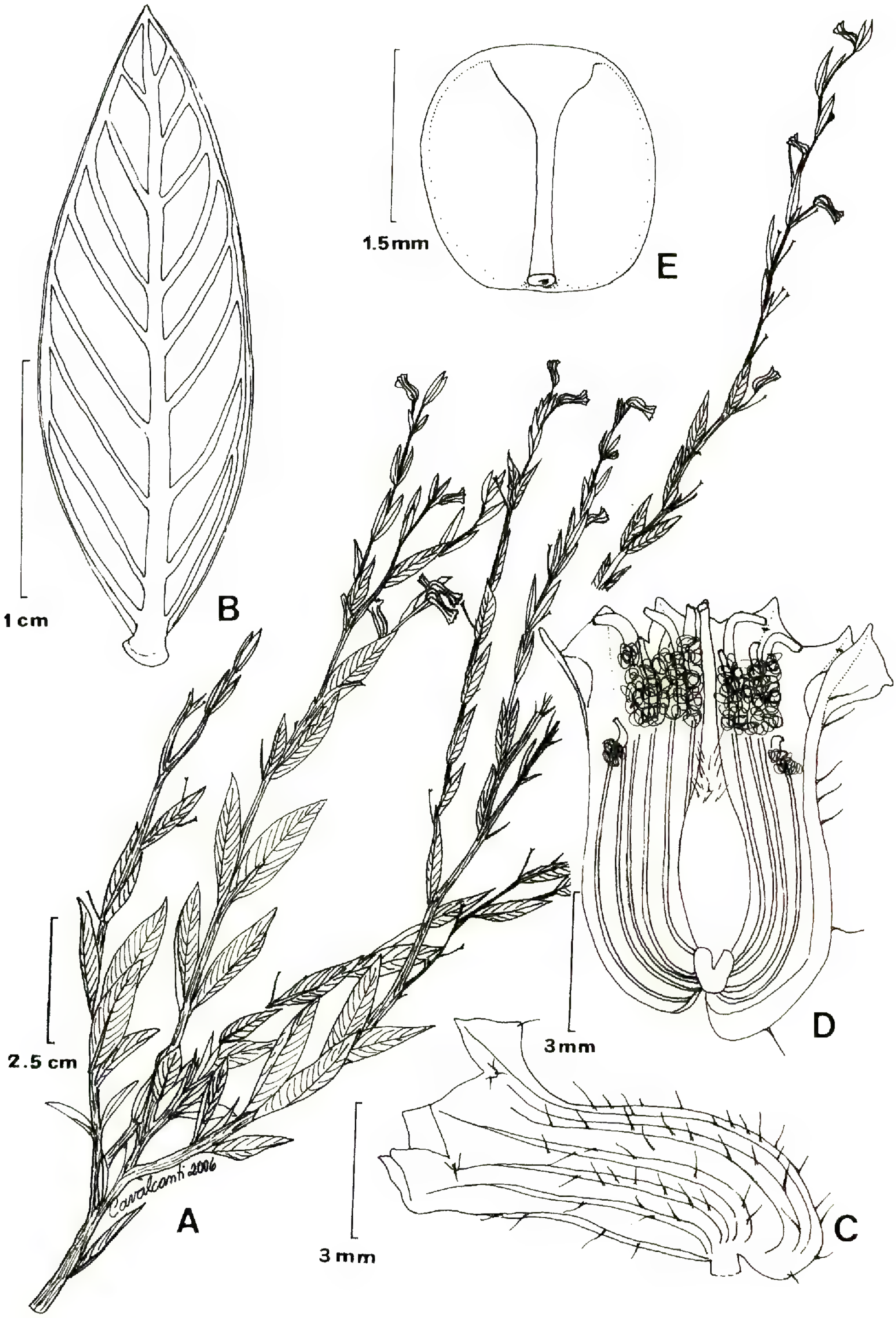

Figure 2. *Cuphea anamariae* T. B. Cavalcanti & S. A. Graham. —A. Habit. —B. Leaf, abaxial surface. —C. Floral tube, lateral view. —D. Floral tube, opened along the mid-dorsal line. —E. Seed, adaxial view. Drawn from the paratype (*Hatschbach et al. 66217*, CEN).

narrowly lanceolate, sessile leaves, some falcate, with rounded base; slender flowers ca. 9 mm long with a strongly descending spur, floral tube lacking vesicles, internally totally pilose or rarely pilose only above the stamens. The species belongs among those currently classified in sect. *Euandra* subsect. *Hilariella* based on the presence of included stamens that extend to the margin of the floral tube, but no other

species of the section closely resemble it. The type was originally identified as *C. pseudovaccinium* A. St.-Hilaire, a species found in the same geographical area and which it resembles in its irregularly branching subshrub habit, but not at all in the morphology of the floral tube, which is slender (ca. 2 mm wide in lateral view) with a descending spur rather than, as in *C. pseudovaccinium*, thicker (ca. 3 mm wide in lateral view) and enlarged basally with a short, horizontal spur. The leaves of *C. pseudovaccinium* are also typically smaller (9–15 × 4–7 mm) and ovate.

Paratype. BRAZIL. **Minas Gerais**: Joaquim Felício, Serra do Cabral, [17°45′S, 44°10′W], 14 Mar. 1997, *G. Hatschbach, E. Barbosa & M. Hatschbach 66217* (CEN, MBM not seen).

3. Cuphea exilis T. B. Cavalcanti & S. A. Graham, sp. nov. TYPE: Brazil. Pará: Serra do Cachimbo, [9°18′S, 55°17′W], 425 m, 12 Dec. 1956, *J. M. Pires, G. A. Black, J. Wurdack & N. T. Silva 6117* (holotype, UB; isotype, IAN). Figure 3.

Ad sect. *Euandram* Koehne subsect. *Oidemation* Koehne pertinens, sed ab speciebus omnibus uninervis sect. *Euandrae* foliis lanceolato-linearibus, griseo-glaucis, 3–12 × 1–3 mm, arcte cauli appressis, praeter marginem glabris, margine folii pilis setosis, ciliatis ornata; floribus 6–7 mm longis, base horizontali-rotundata, introrsum infra stamina duo brevia villosis, vesiculis nullis, pedicellis 1–2.5 mm longis, epicalyce non evoluto, seminibus oblongis, ca. 3 × 2.5 mm, marginibus crassis distinguenda.

Perennial herbs to 40 cm tall, stems erect, wiry, red-brown, one or more probably from an enlarged xylopodium, unbranched below, sparsely branched in the inflorescence, the branches varying in length, 1–18 cm, stems hirsute and microscopically hispid, the hirsute trichomes glandular-viscous, to 0.2 mm, the hispid trichomes white, erect, sharp; internodes mostly equal to or shorter than the subtending leaves. *Leaves* subopposite, appressed to stem, not imbricate, sessile; blades narrowly lanceolate-linear, uninerved, tapering slightly from base to apex, 3–12 × 1–3 mm, thickly membranous, base obtuse, apex acute, margin thick, plane, sparsely white punctate or short white glandular-ciliate; blade surfaces gray-green, glaucous, glabrous except margin sparsely ciliate, trichomes of young leaves minute, sparse, white, glandular, secondary venation not visible on either surface; leaves very gradually reduced in size toward the stem apex. *Inflorescences* frondose terminal racemes; flowers interpetiolar, alternate; pedicels 1–2.5 mm, attached ventrally, persistent; bracteoles lanceolate-ovate, ca. 0.7 × 0.2 mm, persistent at the apex of the pedicel. *Floral tubes* 6–7 × 1.2–1.5 mm including a rounded, horizontal spur 0.5–0.7 mm long, the spur slightly enlarged dorsally, neck scarcely or not at all contracted, mouth upturned, expanded, 4 mm diam.; outer surface deep wine-colored, minutely white hispid and glandular-hirsute, hirsute trichomes ca. 0.1 mm; inner surface glabrous above the stamens, densely white villous in 2 lines below the 2 dorsalmost short stamens, otherwise lightly pilose to glabrous below the stamens, vesicles 0; sepals equal, ca. 1 × 1 mm, deltate, apex acuminate; epicalyx segments absent or merely thickenings at the edge of the sinus, margin not setose, scarcely free; petals subequal, ca. 2 × 1 mm, linear or narrowly obovate, light purple, caducous; stamens 11, included, 2 dorsalmost shortest and most deeply inserted, the others reaching the sinus of the sepals, filaments densely white villous; pollen oval-triangular, tricolporate, syncolpate, pores strongly protruding, exine striate, 3 or 4 coarse striae flanking the pores, the rest of exine finely striate to psilate, grain diam. 18–20 µm; style included, glabrous; ovary glabrous; ovules 3; nectariferous disc thick, ca. 1 × 1 mm, oblique, slightly trilobed in dorsal view. *Seeds* oblong, ca. 3 × 2.5 mm, margin thick, rounded, slightly paler brown than rest of seed.

Distribution and ecology. Brazil. Pará; Serra do Cachimbo in the southwestern corner of the state; open wet grassy savanna on sandstone; 425 m.

IUCN Red List category. Information from the only two specimens of the species is too limited to determine the conservation status of the taxon. The status of *Cuphea exilis* is consequently considered Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Phenology. In bud and flower in mid-December with mostly immature seeds.

Relationships. There are several species of *Cuphea* sect. *Euandra* subsect. *Oidemation* with uninerved, lanceolate to linear leaves in the cerrado and grassy campos of eastern Brazil. *Cuphea exilis* is distinctive among them in having gray-green glaucous leaves and the leaf margin ciliated by minute white glandular trichomes when young. The pale gray color of the leaves, which are tightly appressed to the stem, contrasts strongly with the red-brown stems. Uniquely, too, for this uninerved group, the seeds of *C. exilis* are oblong, not orbicular with an obtuse to retuse apex as is typical of the subsection. Based on total morphology, the species belongs in subsection *Oidemation* although the presence of a xylopodium, diagnostic of the subsection, has not been confirmed. If roots instead are merely fibrous, the species keys in Koehne's (1903) monograph near

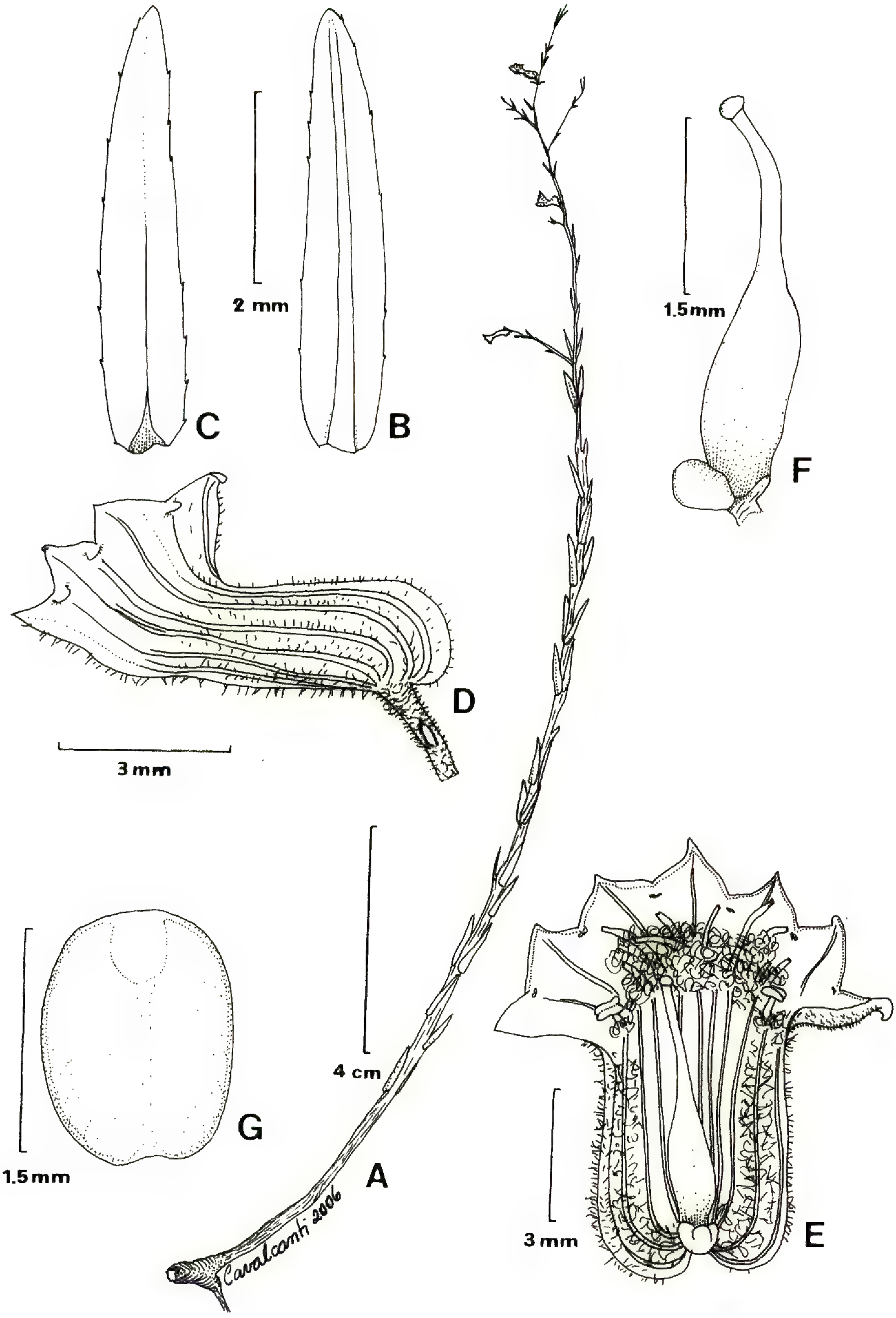

Figure 3. *Cuphea exilis* T. B. Cavalcanti & S. A. Graham. —A. Habit. —B. Leaf, abaxial surface. —C. Leaf, adaxial surface. —D. Floral tube, lateral view. —E. Floral tube, opened along the mid-dorsal line. —F. Gynoecium, subtended unilaterally by the nectariferous disc. —G. Seed, adaxial view. Drawn from the holotype (*Pires et al. 6117*, UB).

C. sclerophylla Koehne in sect. *Euandra* subsect. *Hilariella*, a species with spreading, long, linear leaves (20–63 mm) and longer flowers (7.5–10 mm). The IAN isotype was annotated by A. Lourteig as *C. ericoides* Chamisso & Schlechtendal, a species of section *Trispermum*, and the U paratype as *C. hyssopoides* A. St.-Hilaire of sect. *Euandra* subsect. *Oidemation*.

Paratype. BRAZIL. **Pará**: Km 798, BR-163, Cuiabá–Santarém Hwy., vic. of Cachimbo Airport, Serra do Cachimbo, [9°18′S, 55°17′W], 11 Nov. 1977, *G. T. Prance, A. S. Silva, C. C. Berg, A. J. Henderson, B. W. Nelson, M. Balick, R. P. Bahia & R. dos Santos 25233* (MO, U 16063).

4. Cuphea filiformis T. B. Cavalcanti & S. A. Graham, sp. nov. TYPE: Brazil. Distrito Federal: Brasília, cerrado próximo Escola Fazendária, direita, sentido RECOR (IBGE), [15°47′S, 47°55′W], 24 Sep. 1979, *L. Coradin, A. C. Allem, J. G. Vieira & G. Pereira-Silva 2371* (holotype, CEN; isotypes, BHCB, K, MO, SPF, W). Figure 4.

Ad sect. *Euandram* Koehne subsect. *Oidemation* Koehne pertinens, sed a *Cuphea spermacoce* A. St.-Hilaire foliis laminis fere carentibus, 3(4)-verticillatis, linearibus, griseo-viridibus, 20–55 × 0.7–1.5 mm differt.

Perennial herbs 30–60 cm tall, not viscous, stem solitary from a globose xylopodium, erect, unbranched or sparsely branched distally, minutely strigose with white, antrorsely oriented trichomes mixed with sparse longer, glandular-hirsute trichomes, or the indument entirely minutely hispid; internodes shorter than the subtending leaves. *Leaves* mostly 3(4)-verticillate, subopposite toward base of stem, ascending, not appressed to the stem, sessile; blades narrowly linear, uninerved, 20–55 × 0.7–1.5 mm, consisting primarily of a thick midvein, the blade scarcely developed, base attenuate, apex acute, margins plane, parallel; blade surfaces finely scabrous, gray-green, appearing glabrous, but with dense, minute trichomes; leaves not reduced in size toward the stem apex. *Inflorescences* frondose racemes; flowers interpetiolar, alternate or paired at the nodes; pedicels 4–7 mm, not consistently persistent, attached ventrally; bracteoles ovate, ca. 0.5 × 0.3 mm, at apex of pedicel. *Floral tubes* 7–9 × 2–3 mm at anthesis including a rounded, distinctly descending spur extending ca. 1.5 mm beyond the pedicel attachment, neck scarcely contracted in flower or fruit, mouth blunt to slightly flaring and upturned, 2.5–3 mm diam.; outer surface wine-colored dorsally with dark wine-colored veins, paler ventrally, appressed strigose and sparsely glandular-hispid or finely glandular-hispid and pubescent; inner surface white, villous above the stamens, densely to sparsely villous below them, vesiculate, 8 to 10 vesicles prominent between most or all stamen bases; sepals equal, ca. 1.5 × 1.5 mm, deltate, apex acute, margin not ciliated; epicalyx segments thickened calloses, hispid, scarcely free at the margin; petals 6, subequal, 4.5–6 × 1.5–2 mm, narrowly oblong, rose-colored, caducous; stamens 11, included, 2 dorsalmost shortest and most deeply inserted, the others gathered ventrally, antesepalous stamens reaching the sinuses of the sepals, antepetalous stamens deeper, filaments purple, densely to sparsely white villous, those of the 3 ventral antesepalous stamens sparsely villous to glabrous, anthers white; pollen oval-triangular, tricolporate, syncolpate, pores protruding, exine finely striated, grain diam. ca. 20 μm; style included, reaching the sinus of the sepals at capsule maturity, base of style and apex of ovary pilose; stigma punctiform; ovules 3; nectariferous disc thick, oblique, slightly cupping the ovary, 0.5–1 mm wide × ca. 0.5 mm deep. *Seeds* suborbicular, ca. 3 × 2.7 mm, brown, apex obtuse with prominent raphe, margin thick, rounded, neither pale, distinctively rolled, or thinned.

Distribution and ecology. Brazil. Goiás and the Distrito Federal; disjunctly distributed in northern Goiás and the Distrito Federal; cerrado, dry to locally moist or wet to inundated areas; 800–1230 m.

IUCN Red List category. Conservation status for *Cuphea filiformis* is estimated to fall within the Endangered (EN) category according to IUCN Red List criteria (IUCN, 2001). Few specimens are known and where the species has been observed in northern Goiás, the population consists of one to few individuals. Furthermore, the species was not present in 2005 at the type locality, which is now a heavily disturbed area within the city of Brasília.

Phenology. Observed in flower and fruit September to February.

Relationships. Cuphea filiformis is immediately recognizable by the long, nearly bladeless, verticillate, uninerved leaves. The flowers, which are long-pedicellate, can scarcely be distinguished from those of *C. spermacoce*, but the uninerved leaves and the predominance of strigose stem indument on three of the four collections suggest it is not merely an extremely narrow-leaved variant of *C. spermacoce*. There are narrow-leaved plants within *C. spermacoce* (described in this study as *C. spermacoce* var. *arguta* T. B. Cavalcanti & S. A. Graham, var. nov.), but the secondary venation is clearly evident on their broader leaves and the stem indument is typical of *C. spermacoce*, i.e., a mix of minute, erect, eglandular trichomes (hispid indument) and longer glandular-viscous trichomes (hirsute indument). *Cuphea filiformis* is clearly closely related to *C. spermacoce*, a species common to Goiás and Minas Gerais, but there are no known intermediate collections. Searches for the species at the type locality in the Distrito Federal were unsuccessful and it is unlikely to be found due to heavy disturbance in that urban area. A paratype locality in the Distrito Federal is now within the grounds of a restricted government naval facility and off-limits to collectors. The paratype collection

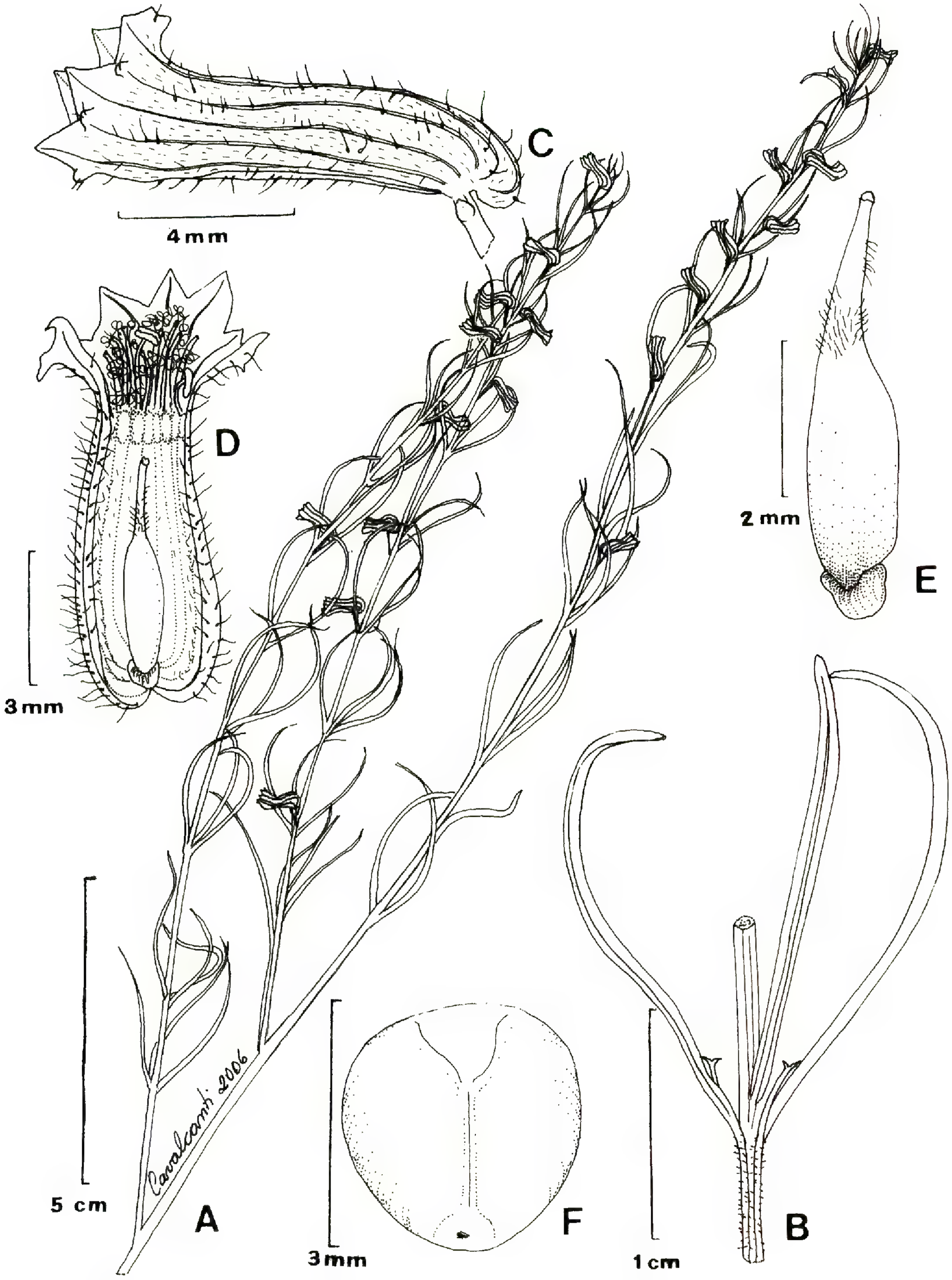

Figure 4. *Cuphea filiformis* T. B. Cavalcanti & S. A. Graham. —A. Habit. —B. Stem node with 3-verticillate leaves and remains of two interpetiolar pedicels. —C. Floral tube, lateral view. —D. Floral tube, opened along the mid-dorsal line. —E. Gynoecium, subtended by nectariferous disc semi-cupping the ovary. —F. Seed, adaxial view. Drawn from the holotype (*Coradin et al. 2371*, CEN).

Cavalcanti et al. 3641 is isolated in northern Goiás and differs from the specimens collected in the Distrito Federal only by the emphasis on eglandular and glandular trichomes and the absence of minutely strigose indument. In northern Goiás, *C. filiformis* could be confused vegetatively with *C. acicularis* Koehne (sect. *Euandra* subsect. *Hilariella*). That species, however, has malpighiaceous trichomes

oriented longitudinally on the stem and the floral spur is rounded and horizontal, not distinctly descending as in *C. filiformis*.

Paratypes. BRAZIL. **Distrito Federal**: Saia Velha, [15°47′S, 47°55′W], 15 Feb. 1965, *E. P. Heringer 10081* (UB); Brasília, área da marinha, campo de murundum, [15°47′S, 47°55′W], 19 Dec. 1991, *R. C. Mendonça, M. C. S. Jr., N. R. O. & T. S. Filgueiras 2051* (CEN). **Goiás**: Cavalcante, GO-118, Teresina de Goiás–Alto Paraíso de Goiás, Km 210 da rodovia, 13°53′02″S, 47°20′47″W, 18 Nov. 2005, *T. Cavalcanti, G. Pereira-Silva & S. Graham 3641* (CEN, MO).

5. Cuphea lucens T. B. Cavalcanti & S. A. Graham, sp. nov. TYPE: Brazil. Minas Gerais: Indianópolis, Fazenda Seríema, margin of gallery forest, 19°03′S, 47°57′W, 28 Feb. 1986, *G. Gottsberger & J. Döring 31-28286* (holotype, CEN; isotype, L not seen). Figure 5.

Ad sect. *Melvillam* Koehne subsect. *Pachycalicem* Koehne pertinens, sed a speciebus similibus subsectionis, imprimis specialiter *Cuphea cylindracea* S. A. Graham, caulibus glabris vel leviter et sparse pubescentibus, foliis coriaceis, nitidis; tubo florali flavo, 18–22 mm longo, calcari brevi, 0.5–1 mm longo, horizontali-rotundato, segmentis epicalycis cylindricis et ovulis 7 ad 8 differt.

Perennial herbaceous shrubs 1–1.5 m tall, stems with ascending branches, glabrous or very sparsely pubescent, the trichomes minute, glandular, erect; internodes shorter than the subtending leaves. *Leaves* decussate, often crowded toward the tips of the branches, subsessile, petioles 1–3 mm; blades ovate-lanceolate, 12–37 × 5–20 mm, typically ca. 25 × 12 mm, coriaceous, base rounded or nearly so, apex acute or obtuse with very short acuminate tip, margin thickened to slightly inrolled; blade surfaces shining, glabrous except microscopic scabrous indument ca. 0.5 mm wide bordering the adaxial leaf margins, abaxial surface paler yellow-green, secondary and some tertiary venation conspicuous on both surfaces; leaves gradually reduced in size toward the stem apex. *Inflorescences* frondose racemes; flowers interpetiolar on main stem or on abbreviated axillary branchlets, alternate; pedicels ca. 4 mm; bracteoles ovate, ca. 0.75 × 0.4 mm, at apex of pedicel. *Floral tubes* 18–22 × ca. 4 mm including a rounded, horizontal spur 0.5–1 mm, floral tube uniformly broad in lateral view, neck not contracted in fruit, mouth blunt to slightly oblique by extension of the ventral side; outer surface yellow, the basal ca. 5 mm of the tube sparsely white pubescent to hirsute, the remainder glabrous; inner surface lightly villous above the stamens, glabrous between stamen insertion and level of the ovary, short-villous surrounding the ovary and along the veins of the 2 dorsalmost short stamens, the trichomes ± cylindrical, not flat and wide; epicalyx segments cylindrical, each bearing a glandular seta, erect in bud, exceeding the sepals; sepals broad, shallowly deltate, 0.3–0.5 × 1.5–1.7 mm, margin glabrous; petals 6, equal, 1–2 × 0.3–1 mm, cuneate-oblong, red; stamens 11, 2 dorsalmost shortest, inserted at ca. the same level as the ventral 9, antesepalous stamens glabrous, long exserted at maturity, antepetalous stamens villous, reaching the margin of the tube, filaments and anthers red; pollen diporate, the grain ca. 27 μm long; style included, becoming exserted with capsule maturity, surpassing the stamens, glabrous; ovary non-gibbous, glabrous; ovules 7 or 8; nectariferous disc ca. 3 × 2.5 mm, oblique, thick, semi-clasping the ovary, narrowly triangular in dorsal view, apex slightly deflexed. *Seeds* ca. 3 × 2.5 mm, suborbicular, margin rounded, not distinctively rolled or thinned, apex obtuse to retuse.

Distribution and ecology. Brazil. Minas Gerais, known only from the type collection.

IUCN Red List category. Conservation status for *Cuphea lucens* must be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001) because the species is only known from the type collection.

Phenology. In flower and fruit in February, probably flowering January to ca. April.

Relationships. *Cuphea lucens* shares a large number of features with the Amazonian species of sect. *Melvilla* subsect. *Pachycalyx* including thick, coriaceous, nitidulous leaves, elongate yellow floral tubes with much-reduced petals, and an ovary surrounded by a villous ring of trichomes (Graham, 1990). Among these species, *C. lucens* most closely resembles *C. cylindracea* from southern Pará but differs by the short horizontal, rather than large descending spur; the nearly glabrous stems; cylindrical, not flattened, epicalyx segments; and seven or eight ovules, rather than five.

The presence of *Cuphea lucens* in southwestern Minas Gerais is notable because morphologically similar species of the subsection are distantly distributed in the savannas of Amazonian Brazil, Venezuela, and Colombia (i.e., *C. annulata* Koehne, *C. andersonii* S. A. Graham, *C. cylindracea*, and *C. egleri* Lourteig). Although four members currently classified in subsection *Pachycalyx* do occur in Minas Gerais, morphological and molecular data (Graham, 1990; Graham et al., 2006) indicate they are not closely related to the Amazonian species of the subsection and presumably not to *C. lucens*. Instead, they are related to species of section *Euandra* and differ from *C. lucens* by their deeply inserted

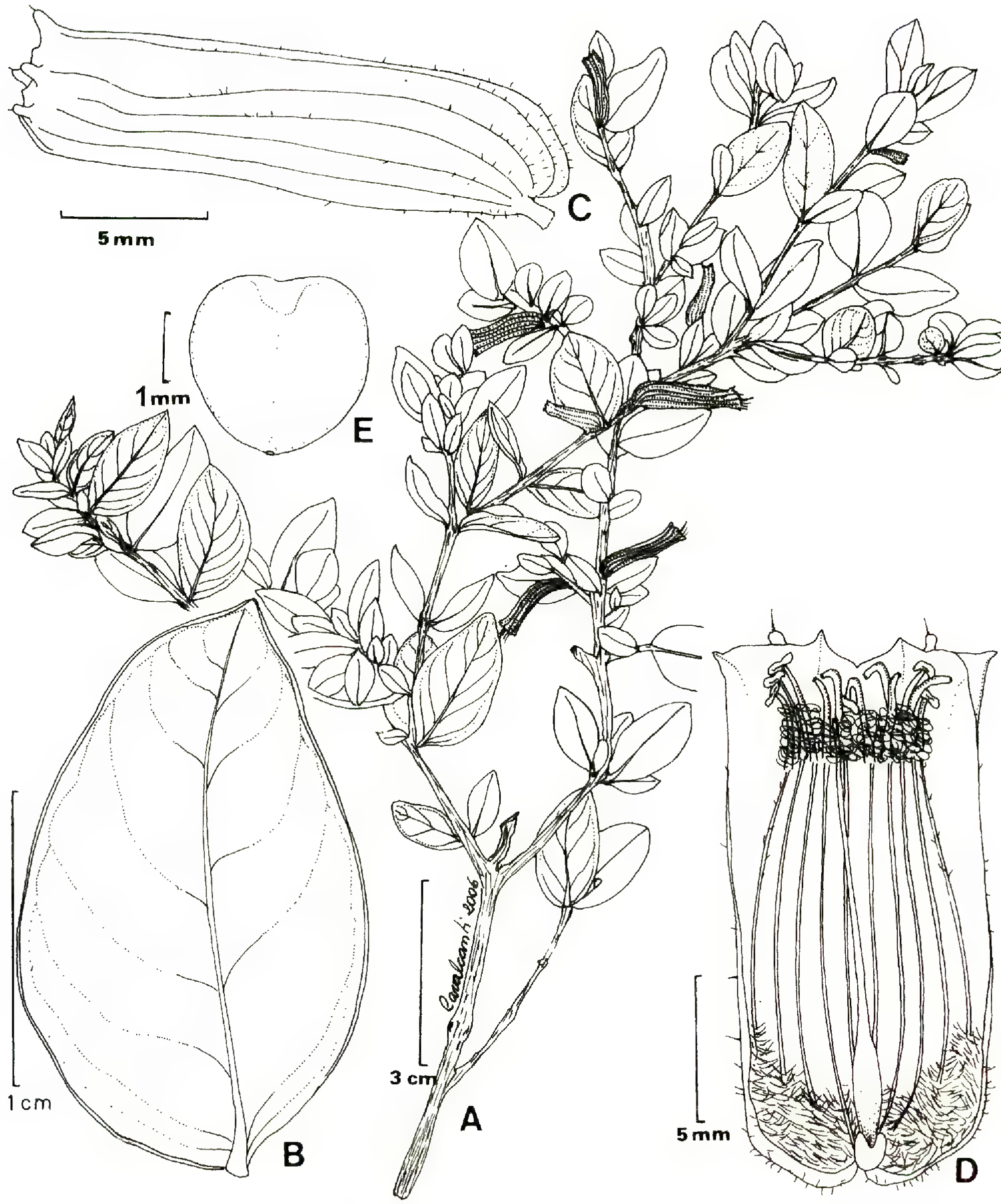

Figure 5. *Cuphea lucens* T. B. Cavalcanti & S. A. Graham. —A. Habit. —B. Leaf, abaxial surface. —C. Floral tube, lateral view. —D. Floral tube, opened along the mid-dorsal line. —E. Seed, adaxial view. Drawn from the holotype (*Gottsberger & Döring 31-28286*, CEN).

dorsalmost stamens (*C. teleandra* Lourteig); or are more correctly classified in section *Pseudocircaea* by their persistent petals and thin membranous leaves (*C. gardneri* Koehne, *C. fuchsiifolia* A. St.-Hilaire); or are classified in subsection *Pachycalyx* but are morphologically distant from *C. lucens*, having a decumbent herbaceous habit and tiny subfleshy leaves with glandular-ciliate margins (*C. froesii* Lourteig). It is not possible at present to re-collect this interesting species because the type locality is on inaccessible private land.

6. Cuphea rupestris T. B. Cavalcanti & S. A. Graham, sp. nov. TYPE: Brazil. Goiás: Pirenópolis, [15°50′S, 48°57′W], estrada que leva ao Parque Estadual Serra dos Pirineus, 30 Dec. 2004, *J. F. Pastore & E. Suganuma 1209* (holotype, CEN; isotypes, K, NY). Figure 6.

Ad sect. *Euandram* Koehne subsect. *Oidemation* Koehne pertinens, sed a speciebus sect. *Euandrae* omnibus foliis verticillatis praeditis foliis parvis, 15–25 × 1–5 mm, uninervia apparentibus apicem versus contractis, basim rotundatis vel cordatis, marginibus involutis, trichomatibus

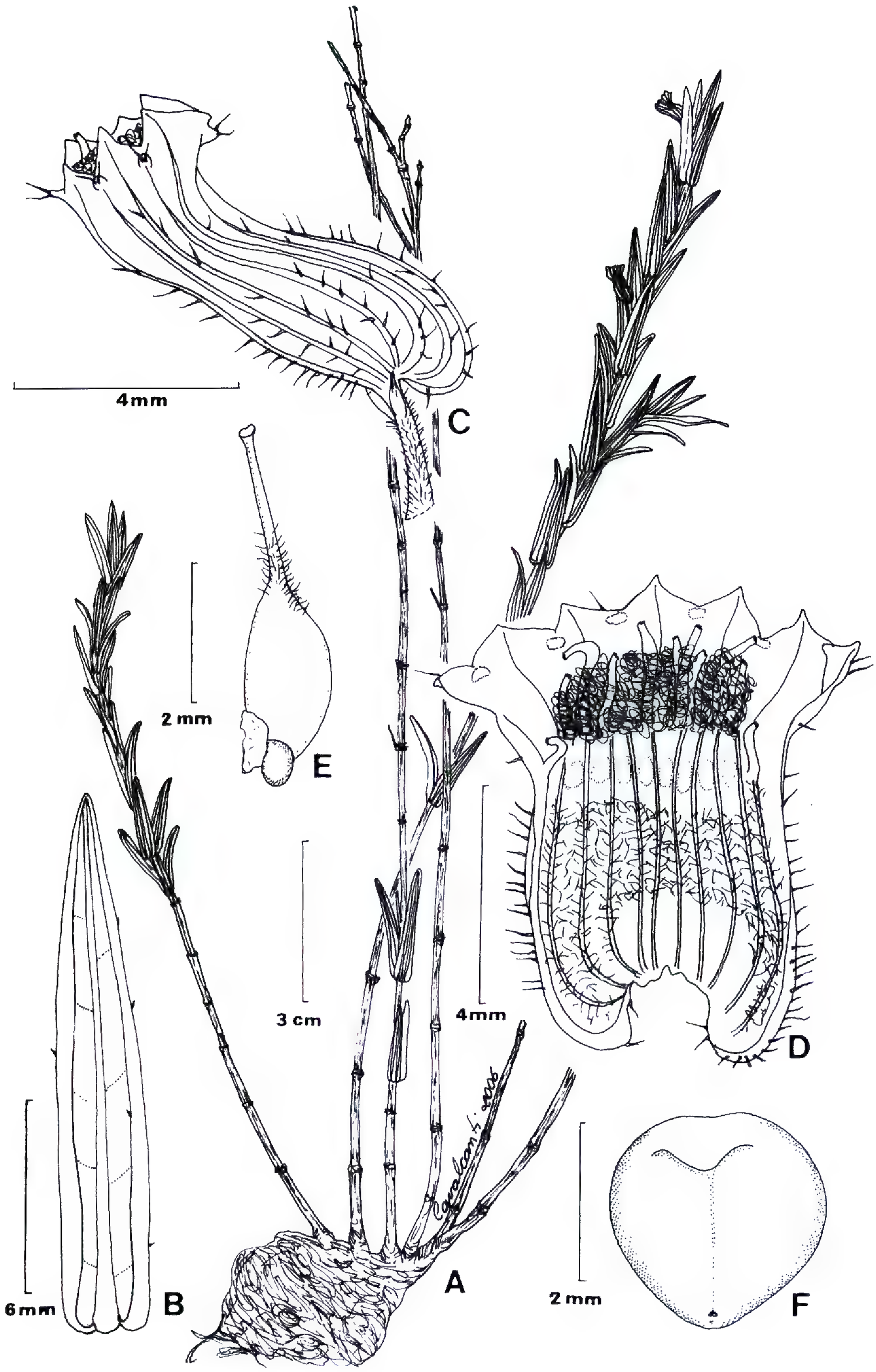

Figure 6. *Cuphea rupestris* T. B. Cavalcanti & S. A. Graham. —A. Habit including xylopodium. —B. Leaf, abaxial surface. —C. Floral tube, lateral view. —D. Floral tube, opened along the mid-dorsal line. —E. Gynoecium, subtended by the nectariferous disc, the disc attached on the left to tissue of the floral tube. —F. Seed, adaxial view. Drawn from the holotype (*Pastore & Suganuma 1209*, CEN).

malpighiaceis transverse orientibus, tubo florali 7–9 mm longo, calcari fortiter descendenti et petalis roseis differt.

Perennial herbs 30–50 cm tall, stems 1 to 6, dark red-brown, from a woody, elongated to globose xylopodium, unbranched or sparsely branched toward the base, minutely hispid and glandular-hirsute, hispid trichomes white, sharp-pointed, slightly ascending, glandular trichomes sparser, erect, ca. 0.5 mm; internodes ca. half as long as the subtending leaves. *Leaves* 3-verticillate or subopposite, erect, appressed against stem, frequently imbricate, sometimes with vegetative fascicles in the axis, sessile; blades linear-lanceolate, distinctly tapered from base to apex, superficially appearing uninerved but secondary venation visible on widest leaves, 15–25 × 1–5 mm, thickly membranous, base rounded to cordate, apex acute, margin slightly to strongly inrolled, on young leaves the margin bearing minute, malpighiaceous, transversely oriented trichomes (at 40× magnification); blade surfaces minutely scabrous, appearing glabrous, abaxially with or without sparse glandular trichomes; leaves not reduced in the inflorescence. *Inflorescences* frondose terminal racemes; flowers interpetiolar, alternate; pedicels 5–9 mm, persistent, attached ventrally; bracteoles narrowly ovate, ca. 0.5 × 0.2 mm. *Floral tubes* 7–9 × ca. 2 mm including a distinctly descending rounded spur extending ca. 1 mm beyond the pedicel, neck slightly contracted, mouth upturned, as wide as the floral tube, not flaring; outer surface deep wine-colored dorsally, green ventrally, sparsely to densely glandular-hirsute; inner surface densely white villous above the stamens, villous to sparsely villous below them, vesicles (0)5 to 8, prominent when present; sepals equal, ca. 1 × 1 mm, deltate; epicalyx segments small thickenings, bearing a few short setae, margin scarcely free; petals 6, subequal, ca. 4 × 1.5 mm, oblong to obovate, rose to light rose; stamens 11, 2 dorsalmost shortest and most deeply exserted, the others slightly exserted, with villous filaments, anthers white; pollen oval-triangular in polar view, tricolporate, syncolpate, pores strongly protruding, exine striate, 1 to 4 coarse striae flanking the pores and extending half or less the distance to the pole, grain diam. 25 μm; style glabrous distally, pilose basally, included, slightly exserted in fruit; ovules 3 or 4; nectariferous disc thick, oblique, slightly cupping base of ovary, ca. 0.5 × 1 mm, triangular in dorsal view. *Seeds* 2.8–3 × ca. 2.5 mm, oblong-ovate, margin rounded, not distinctively rolled or thinned, apex obtuse.

Distribution and ecology. Brazil. Goías; open rocky areas, cerrado, campo rupestre, campo limpo seco, and campo sujo, in sand and rocky sandstone soils; 1100–1350 m.

IUCN Red List category. Cuphea rupestris is narrowly distributed in a single serra where it is restricted to higher altitude, relatively undisturbed open, rocky, dry areas. In the Parque Estadual Serra dos Pirineus, the populations of *C. rupestris* are small, scattered, and vulnerable because of unrestricted access to the area. For these reasons, the species is best classified as in the category Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Observed in flower and fruit November to March.

Relationships. Cuphea rupestris belongs to the *C. spermacoce* complex of species (sect. *Euandra* subsect. *Oidemation*) as evidenced by the xylopodium, the mix of minute hispid and glandular-hirsute indument, long-pedicellate and vesiculate floral tubes, and the relatively large seeds with an obtuse apex. It differs from other linear, verticillate-leaved species in the subsection by leaves cordate at the base, tapered to the apex, and variably inrolled as far as the midvein, and by floral tubes with rose-colored petals, a deeply descending spur, and ovate bracteoles. There are no malpighiaceous trichomes on the stem, but under 40× magnification dense, malpighiaceous, transversely oriented trichomes appear on the rolled margin of the young leaves. *Cuphea rupestris* can be confused at a superficial level with *C. acicularis* (sect. *Euandra* subsect. *Hilariella*) because of the similar verticillate, linear leaves. In that species, however, the spur of the floral tube is horizontal, not descending; petals are white or, less often, pale pink; and stems bear longitudinally oriented malpighiaceous trichomes. The disjunct distribution pattern of *C. rupestris* is related to its specialized habitat. It is restricted to rocky, open, relatively undisturbed campo rupestre in cerrado at altitudes above 1100 m. This habitat type occurs on the Serra dos Pirineus in central Goiás and disjunctly to the northeast in the Chapada dos Veadeiros, Goiás.

Paratypes. BRAZIL. **Goiás**: Cavalcante, Aldeia Kalunga de Cavalcante, [13°41′S, 47°28′W], 6 Mar. 2003, *J. F. Pastore 443* (CEN); caminho para povoado de Kalunga, 3 Feb. 2004, *J. F. Pastore 842* (CEN); caminho para a Cachoeira Santa Bárbara, 6 Nov. 2004, *J. F. Pastore 1101* (CEN); Pirenópolis, Serra dos Pirineus, Cocalzinho–Pirenópolis, Km 10 na estrada da Serra, 15°48′S, 48°48′W, 18 Feb. 1999, *T. Cavalcanti & G. Pereira-Silva 2494* (CEN, MO); estrada Cocalzinho–Pirenópolis, via Serra dos Pirineus, 8.1 km, 15°48′S, 48°48′W, 14 Nov. 2005, *T. Cavalcanti, S. Graham & G. Pereira-Silva 3570* (CEN, MO); Serra dos Pirineus, ca. 11 km N of Corumbá de Goiás, 2 Dec. 1965, *H. S. Irwin, R. Souza & R. Reis dos Santos 10916* (NY, UB); 25 km N of Corumbá de Goiás on rd. to Niquelândia, in valley of Corumbá, 13 Jan. 1968, *H. S. Irwin, H. Maxwell & D. C. Wasshausen 18524* (NY, UB); Alto da Serra dos Pirineus, 7 Dec. 1995, *V. L. Klein 2987* (CEN, UFG); subida para Serra dos Pirineus, 26 Dec. 1968, *N. Lima & A. Lima 685* (UB).

7. Cuphea spermacoce A. St.-Hilaire, Fl. Bras. Merid. (A. St.-Hil.) 3(23): 114. 1833. TYPE: Brazil. s. loc., 1816–1821, *A. St.-Hilaire s.n.* (holotype [as type], P not seen, F neg. #038343 ex P).

7a. Cuphea spermacoce var. **spermacoce** A. St.-Hilaire.

Stem indument a mixture of minute hispid and glandular-hirsute types. *Leaves* mostly 3(4)-verticillate, spreading to ascending; blades ovate-elliptic to oblong or oblanceolate, 20–112 × 9–35 mm. Floral tubes 7–14 mm.

7b. Cuphea spermacoce var. **arguta** T. B. Cavalcanti & S. A. Graham, var. nov. TYPE: Brazil. Goiás: Cristalina, [16°45′S, 47°03′W], ca. 30 km ao N de Cristalina, 60-BR-040, 20 Nov. 1976, *A. C. Allem 513* (holotype, CEN). Figure 7.

Ad sect. *Euandram* Koehne subsect. *Oidemation* Koehne pertinens, sed a varietate typica foliis 3-verticillatis, anguste lanceolato-linearibus, 15–60(–70) × 0.5–6 mm, marginibus gradatim decrescentibus, non revolutis et venis conspicuis secundariis differt.

Stem indument a mixture of minute hispid and glandular-hirsute types. *Leaves* 3-verticillate, sometimes decussate near base of stem, spreading to semi-erect, not appressed, sessile; blades narrowly lanceolate-linear, 15–60(–70) × 0.5–6 mm, typically ca. 40 × 6 mm at midstem, base round or acute, apex sharp, long acute-acuminate, margins tapering toward the apex, plane, not revolute, secondary venation distinctly visible; blade surfaces glabrous or bearing occasional setae. *Floral tubes* 7–9 mm, spur descending.

Distribution and ecology. Brazil. Goiás; cerrado and campo sujo, in sandy and rocky soils, and red-yellow latosols; 800–1200 m.

IUCN Red List category. The conservation status is Data Deficient (DD) based on IUCN Red List criteria (IUCN, 2001). Only two collections are known, and information about population size or threat to the environment in which the species occurs is limited.

Phenology. Known to flower and fruit from September to January; the flowering period probably extending to March based on flowering periods of similar taxa.

Relationships. *Cuphea spermacoce* var. *arguta* is distinguished from the nominate variety by its long, narrow, sharply acute leaves that, despite the narrow blade, still show the prominent secondary venation and strong intramarginal vein typical of *C. spermacoce*. Stem and floral tube trichomes are the same as in variety *spermacoce*, being a mix of minute hispid and glandular-hirsute types (very sparse glandular-hispid trichomes in the Minaçu paratype). The variety differs from *C. filiformis*, a similar narrow-leaved species of the subsection, by the stem indument and the broader leaf blade. Stems of *C. filiformis* bear antrorse strigose trichomes, and the leaves, consisting almost entirely of midvein, are not tapered as in *C. spermacoce* var. *arguta*. The flowers of the two taxa are indistinguishable.

Paratypes. BRAZIL. **Goiás:** Cristalina, [16°45′S, 47°03′W], 12 km S of Cristalina, 3 Nov. 1965, *H. S. Irwin, R. Souza, R. Reis dos Santos 9876* (NY); Minaçu, [13°31′S, 48°13′W], estrada Nova Minaçu–Serra da Mesa, 24 km do asfalto, 11 Oct. 1991, *T. Cavalcanti, B. M. T. Walter, G. Pereira-Silva, H. Garboggini & S. Pinheiro 990* (CEN, MO).

7c. Cuphea spermacoce var. **erectifolia** (Koehne) T. B. Cavalcanti & S. A. Graham, comb. et stat. nov. Basionym: *Cuphea erectifolia* Koehne, Fl. Bras. 13(2): 277, pl. 50, fig. 2. 1877. TYPE: Brazil. Minas Gerais: "Ad Paracatú," [17°13′S, 46°52′W], *J. B. E. Pohl 861* (lectotype, designated here, W; isotypes, BR, K, M [2], OXF).

Cuphea erectifolia f. *angustifolia* Koehne, Fl. Bras. 13(2): 277. 1877. TYPE: Brazil. Minas Gerais: "Ad Paracatú," *J. B. E. Pohl 861* (lectotype, designated here, W, p.p. [the 7 stems marked "a"]; isotypes, F neg. #19610 ex M, M).

Cuphea erectifolia f. *latifolia* Koehne, Fl. Bras. 13(2): 277. 1877. TYPE: Brazil. Minas Gerais: "Ad Paracatú," *J. B. E. Pohl 861* (lectotype, designated here, W, p.p. [the 3 stems marked "b"]; isotypes, F neg. #19610 ex M, M).

Stem indument a mixture of minute hispid and glandular-hirsute types. *Leaves* decussate, rarely 3-verticillate, erect, closely appressed against the stem, sessile; blades narrowly ovate to ovate-elliptic or ovate-oblong, 10–20 × 3–7 mm, typically ca. 16 × 6 mm at midstem, base rounded to subcordate, margin moderately glandular-ciliate or glabrous, plane, or revolute only to the intramarginal vein, apex acute, blade surfaces minutely scabrous, secondary venation visible on both surfaces. *Floral tubes* 8–10 mm, spur descending or rarely horizontal on smallest flowers.

Distribution and ecology. Brazil. Goías and Minas Gerais, restricted to the area near Pieres do Rio, southeastern Goiás east and northeastward to Conselheiro Mata, Minas Gerais; campo limpo, campo rupestre in sandy, quartzite, and rocky soils; 980–1315 m.

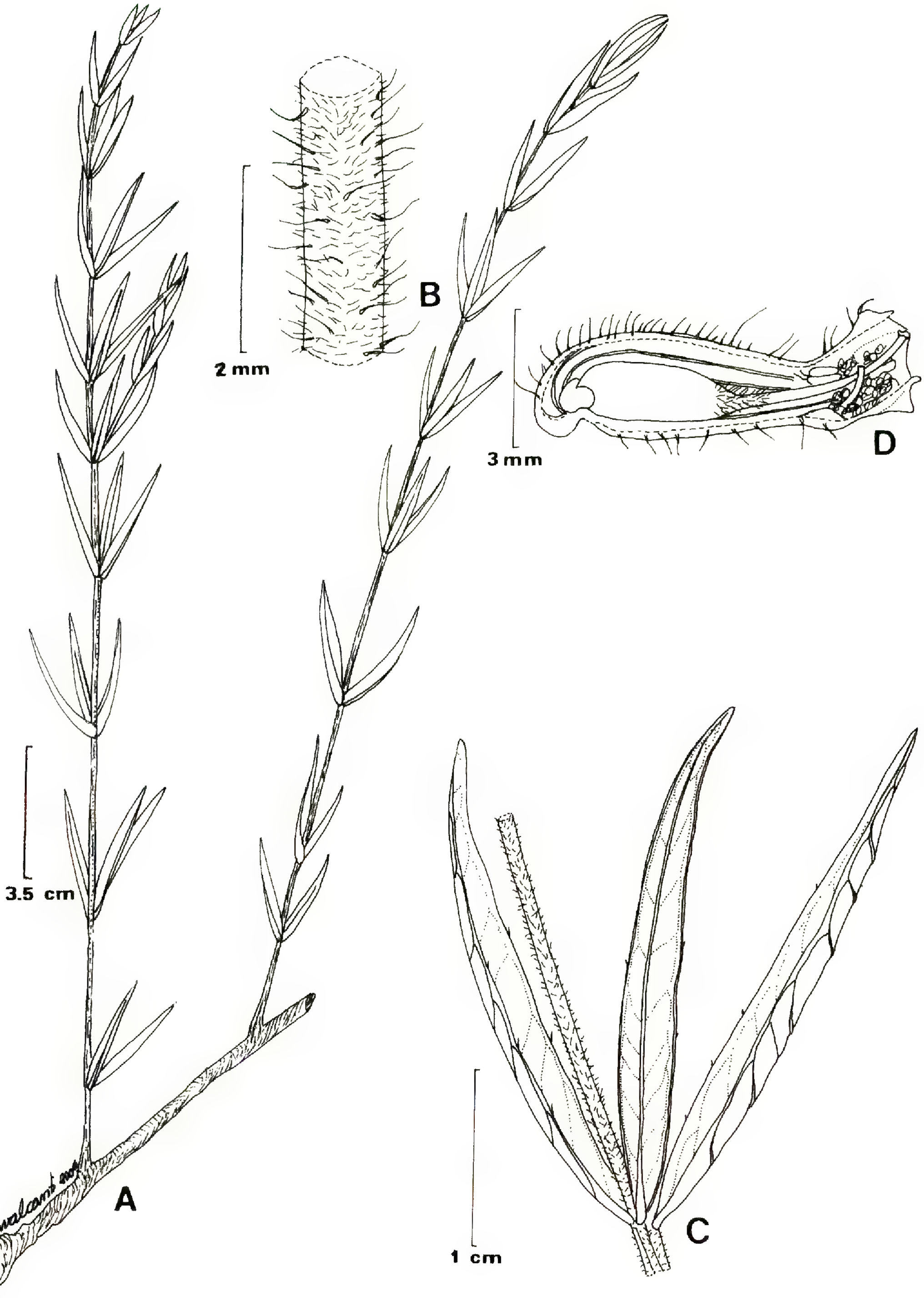

Figure 7. *Cuphea spermacoce* var. *arguta* T. B. Cavalcanti & S. A. Graham. —A. Habit. —B. Minute hispid and glandular-hirsute indument of the stem. —C. Stem node with 3-verticillate leaves. —D. Floral tube, lateral view, opened along one side. Note the pilose ovary apex and large semi-cupping nectariferous disc, typical of *C. spermacoce*. Drawn from the holotype (*Allem 513*, CEN).

IUCN Red List category. Plants of *Cuphea spermacoce* var. *erectifolia*, although occurring at numerous locations, are not present in large numbers. Furthermore, its habitat, on hillsides of relatively natural campo limpo and campo rupestre at elevations typically above 1100 m, is restricted in size and number, fragmented, and part of one of the most threatened ecosystems of northeastern Brazil.

For these reasons, the conservation status of the variety is considered Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Flowering and fruiting August to June, peak flowering December to March.

Relationships. Leaves of variety *erectifolia* are typically ovate with a rounded base and closely appressed to the stem. The prominent secondary venation of the species is apparent on the largest leaves. The flowers do not differ from those of variety *spermacoce* or variety *arguta*. Variety *erectifolia* has narrow ecological parameters, occurring only on hillsides of relatively natural campo limpo and campo rupestre at elevations above 980 m and most commonly above 1100 m.

Cuphea erectifolia was described by Koehne (1877: 277) with the citation "Habitat in provincia Minas Geraës ad Paracatú: *Pohl n. 861* (formae a. et b. intermixtae)." Later references to *C. erectifolia* by Koehne (1881: 158, 1903: 139) added no information as to where the specimens he studied were housed, nor were additional collections cited. Several sheets of *Pohl 861* are known, but because the institution housing the specimens of *Pohl 861* used by Koehne to prepare the description is not known with certainty, the type of *C. erectifolia* therefore, according to Rec. 9A.4 of the *International Code of Botanical Nomenclature* (McNeil et al., 2006), is assumed to have been at Berlin where it was subsequently destroyed. The specimen at W annotated by Koehne is considered the best choice as lectotype for *C. erectifolia* and for the forms found intermixed on the sheet and annotated by Koehne. Among other sheets at M, one including both forms (F neg. #19610 ex M) was seen by Pohl, but the collection number is missing and there is no evidence Koehne ever saw this specimen, thus it was excluded as a lectotype choice.

Paratypes. BRAZIL. **Goiás**: Cristalina, [16°45′S, 47°03′W], rod. de terra Cristalina-PADF, 2.7 km da BR-040, 27 Sep. 2002, *T. Cavalcanti, G. Pereira-Silva, J. B. Bringel & M. Carvalho-Silva 3059* (CEN, MO, SPF); 6 km NW of Cristalina, 16 Mar. 1982, *S. Graham 891, 893* (MO, NY); Serra dos Cristais, BR-040, 3–4 km O trevo com a rod. BR-050, 4 Dec. 1992, *G. Hatschbach 58412* (MO); Cristalina, 15 Aug. 1967, *E. P. Heringer 11535* (UB); Serra dos Cristais, 12 km S of Cristalina, 3 Nov. 1965, *H. S. Irwin, R. Souza & R. Reis dos Santos 9878* (NY, UB); Pires do Rio, [17°17′S, 48°16′W], BR-050, em direção a Cristalina, 10 Oct. 1988, *R. Kral & M. G. L. Wanderley 75270* (CEN); RPPN Linda Serra dos Topázios, Oct. 1996, *R. S. Oliveira & C. Proença 197* (UB), Dec. 1996, *R. S. Oliveira & C. Proença 204* (UB); RPPN Linda Serra dos Topázios, 13 June 2004, *J. F. Pastore & A. S. Rodrigues 1007* (CEN); Cristalina, 15 Dec. 2004, *J. F. Pastore, A. S. Rodrigues & J. B. Pereira 1142, 1152* (CEN), *J. R. Pirani, A. Furlan, B. L. Stannard, C. Kameyama & R. M. Harley 1518* (CEN), 17 Oct. 1999, *C. Proença et al. 2095* (UB); Km 110 da BR-040, Brasília–Paracatú, 100 m do posto JK-3 Barras, 31 Jan. 1989, *A. O. Scariot, G. Pereira-Silva, J. H. Kirkbride Jr., L. C. Ramos & W. W. Roath 263* (CEN, SPF); Cristalina, ca. 6 Dec. 1988, *M. G. L. Wanderley & R. Kral 1864* (CEN). **Minas Gerais**: Conselheiro Mata, [18°17′S, 43°58′W], estrada de terra, a 3 km após a saída da cidade de Conselheiro Mata, 19 Jan. 2003, *T. B. Cavalcanti, G. Pereira-Silva, M. Carvalho-Silva 3121* (CEN).

The three varieties of the vegetatively variable *Cuphea spermacoce* may be identified by the following key. All share the following: stem indument of minute white hispid trichomes and longer glandular-hirsute trichomes; conspicuous secondary venation of the leaves including a prominent intramarginal vein; long-pedicellate, thick-bodied flowers internally furnished with elongate vesicles at the base of the stamens, a pilose style base and ovary apex, and three ovules; and broad seeds with an obtuse or retuse apex.

KEY TO THE VARIETIES OF *CUPHEA SPERMACOCE*

1a. Leaves narrowly lanceolate-linear, 15–60(–70) × 0.5–6 mm, typically ca. 40 × 6 mm at midstem, apex sharply long acute-acuminate . . . . . .var. *arguta*
1b. Leaves ovate, ovate-elliptic, oblong, or oblanceolate, 10–112 × 3–35 mm, apex acute to obtuse. . . . 2
2a. Leaves narrowly ovate to ovate-elliptic or ovate-oblong, 10–20 × 3–7 mm, typically ca. 16 × 6 mm at midstem, erect, closely appressed against the stem, mostly decussate . . . . . .var. *erectifolia*
2b. Leaves ovate-elliptic to oblong or oblanceolate, 20–112 × 9–35 mm, spreading to ascending, mostly 3(4)-verticillate . . . . . .var. *spermacoce*

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Two New Combinations in *Syringa* (Oleaceae) and Lectotypification of *S. sweginzowii*

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ABSTRACT. Two new combinations are proposed in *Syringa* L. (Oleaceae) based on examination of specimens, population sampling, and character analysis: *S. tomentella* Bureau & Franchet subsp. *yunnanensis* (Franchet) Jin Y. Chen & D. Y. Hong, and *S. tomentella* subsp. *sweginzowii* (Koehne & Lingelsheim) Jin Y. Chen & D. Y. Hong. *Syringa wilsonii* C. K. Schneider is treated as a synonym of *S. tomentella* subsp. *sweginzowii*. The lectotype of *S. sweginzowii* Koehne & Lingelsheim is designated.

Key words: China, Oleaceae, *Syringa*.

Syringa tomentella Bureau & Franchet was described as new by Bureau and Franchet (1891) based on a specimen from Kangding, Sichuan Province, China. Meanwhile, Franchet (1891) described *S. yunnanensis* Franchet as new, based on Delavay's collection from Dali, Yunnan Province, China. Koehne and Lingelsheim (1910) described *S. sweginzowii* Koehne & Lingelsheim as new, based on a plant cultivated in the arboretum of Max von Silvers near Riga, and they believed that it came from East Asia. C. K. Schneider (1913) described *S. tetanoloba* C. K. Schneider, *S. rehderiana* C. K. Schneider, and *S. wilsonii* C. K. Schneider as new based on Wilson's specimens from Sichuan Province, but he later (Schneider, 1917) stated that *S. tetanoloba* was identical to *S. sweginzowii*, that *S. wilsonii* was scarcely different from *S. tomentella*, and that *S. rehderiana* might be only a variety of *S. tomentella*. *Syringa alborosea* N. E. Brown, *S. adamiana* Balfour f. & W. W. Smith, and *S. tigerstedtii* Harry Smith were described as new based on specimens also from Sichuan Province (Brown, 1914; W. W. Smith, 1916; H. Smith, 1948). All of these taxa are closely related. Chang (1992) and Chang et al. (1996) recognized three species in the complex—*S. yunnanensis*, *S. tomentella*, and *S. sweginzowii*—with *S. adamiana*, *S. alborosea*, *S. rehderiana*, and *S. wilsonii* treated as synonyms of *S. tomentella*, and with *S. tetanoloba* and *S. tigerstedtii* as synonyms of *S. sweginzowii*. They stated that the three species differed from each other in indumentum and size of the leaves, the shape of the corolla tube, and the position of the anthers relative to the corolla tube.

To reveal the morphological variation of these species, we examined more than 200 specimens (including all type specimens of the above taxa) and undertook population sampling in Sichuan and Yunnan provinces. The results show that the morphological characters employed by the above authors for taxa delimitation vary continuously. Leaves of *Syringa tomentella* are pubescent, those of *S. yunnanensis* are usually glabrous, and only occasionally pubescent, while those of *S. sweginzowii* are adaxially glabrous and abaxially glabrous to pubescent, showing continuous variation in leaf indumentum. Length of leaf blades varies continuously (1.8–12.2 cm) among the populations, indicating little significance for taxonomy of the complex. To effectively compare the shape of corolla tubes (CTS), we used the formula CTS = (diameter of corolla throat – diameter of corolla base)/ length of corolla tube. The results show that CTS varies continuously among the populations, and that

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the corolla tube of *S. yunnanensis* is slightly funnelform, that of *S. sweginzowii* is generally cylindrical, and that of *S. tomentella* is usually subcylindrical. There are no distinct differences among the three taxa in anther insertion at the corolla tube: varying from near the corolla throat in *S. tomentella*, usually below the corolla throat in *S. sweginzowii*, and below the corolla throat to slightly protruded in *S. yunnanensis*. Our morphological analysis and multivariate analysis show no clear discrimination among the three taxa. *Syringa yunnanensis* and *S. sweginzowii* overlap in their distribution along the border of Sichuan (Muli, Daocheng) and Xizang (Bomi, Zayu), and *S. tomentella* and *S. sweginzowii* are sympatric in Sichuan (Kangding). Rather than the independent recognition of these three species, only one species with three subspecies is therefore recognized according to their morphology and distribution.

1. Syringa tomentella Bureau & Franchet, J. Bot. (Morot) 5: 103. 1891. TYPE: China. Sichuan: Kangding, July 1890, *M. Bonvalot & H. Orleans s.n.* (holotype, P).

Deciduous shrubs to 6 m. Leaves lanceolate, elliptic, ovate to obovate, (1.8–)2.5–9(–10) × (0.7–)1.3–4.1(–5.3) cm, glabrous to densely pubescent, lateral veins in 4 to 8 pairs; petioles 0.3–2 cm. Inflorescences terminal, with leaves at the base, 6–30 × (2–)2.6–14(–22) cm; rachises quadrangular, lenticellate, glabrous to pubescent. Calyx truncate to toothed, glabrous to pubescent, 1–3 × 1–2.5 mm; corolla tube cylindrical to funnelform, pink to pinkish white, (3.5–)4.6–10.3(–13) mm, corolla base 0.6–1.5 mm diam., corolla throat (1–)1.3–2.8(–3) mm diam.; corolla lobes elliptic, triangular to ovate, (1.5–)2.1–4.6(–5) × (0.8–)1–1.9(–3) mm; anthers yellow, 0–2(–3) mm below corolla throat to 0.3–1 mm above corolla throat. Capsule oblong to conical, 10–20 × 3–7 mm, smooth to lenticellate.

Distribution, habitat, and phenology. *Syringa tomentella* is distributed in Sichuan and Yunnan provinces and Xizang Autonomous Region in China, growing in open thickets, forests, or forest margins, at altitudes from 2400–4200 m. Flowering was observed in June. Three subspecies are presented in the key below:

KEY TO THE SUBSPECIES OF *SYRINGA TOMENTELLA*

1a. Leaves usually pubescent adaxially and densely pubescent abaxially; anthers inserted 0–0.1(–0.5) mm below corolla throat. . . . . .subsp. *tomentella* Bureau & Franchet

1b. Leaves usually glabrous adaxially, glabrous to sparsely pubescent abaxially; anthers inserted 0.5–2(–3) mm below corolla throat, rarely protruded to 1 mm 2

2a. Corolla tube usually funnelform, 4.6–8.5 mm, corolla throat 1.6–2.8 mm diam.; leaf blades usually glabrous, only occasionally pubescent . . . . . subsp. *yunnanensis* (Franchet) Jin Y. Chen & D. Y. Hong

2b. Corolla tube usually cylindrical, 5.1–10.3 mm, corolla throat 1.3–2.4 mm diam.; leaf blades usually sparsely pubescent abaxially, rarely glabrous . . . . . subsp. *sweginzowii* (Koehne & Lingelsheim) Jin Y. Chen & D. Y. Hong

1a. Syringa tomentella subsp. **tomentella** Bureau & Franchet.

Syringa rehderiana C. K. Schneider, Pl. Wilson. (Sargent) 1: 299. 1912. TYPE: China. Sichuan: Kangding, 3600–4000 m, July 1908, *E. H. Wilson 1273a* (holotype, A).

Syringa alborosea N. E. Brown, Bull. Misc. Inform. Kew 1914: 187. 1914. TYPE: China. Sichuan: Kangding, 2 June 1914, *E. H. Wilson 1739* (holotype, K).

Syringa adamiana Balfour f. & W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 9: 131. 1916. TYPE: China. Sichuan: Kangding, June 1915, *C. M. Watson s.n.* (holotype, E; isotype, K).

Leaves lanceolate, elliptic to ovate, (3.2–)4.4–7.4(–9.5) × (1.6–)2.1–3.8(–5.3) cm, pubescent adaxially and densely pubescent abaxially. Inflorescences 8–30 × (3–)4.8–9.4(–12) cm; rachises pubescent and lenticellate. Calyx 1.5–2.5 × 1–2.5 mm; corolla tube subcylindrical, (5–)6.6–9.9(–13) mm, corolla base 1–1.5 mm diam., corolla throat (1.2–)1.8–2.5(–3) mm diam.; corolla lobes elliptic to triangular, (1.5–)2.1–3.6(–5) × (1–)1.5–2.2(–3) mm; anthers 0–0.1(–0.5) mm below corolla throat. Capsule oblong to conical, 10–18 × 3–7 mm, smooth to lenticellate.

Distribution, habitat, and phenology. *Syringa tomentella* subsp. *tomentella* is chiefly distributed in Kangding, Sichuan Province, China, growing in open thickets at altitudes between 2400 and 3400 m. Observed as flowering in June.

Representative specimens examined. CHINA. **Sichuan:** Panlanshan, *E. H. Wilson 2584* (K); Kangding, *J. Y. Chen 04174, 04188* (PE), *X. L. Jiang 36042, 36790* (PE), *A. E. Pratt 185* (P), *Z. J. Zhao 114054, 115749* (PE).

1b. Syringa tomentella subsp. **yunnanensis** (Franchet) Jin Y. Chen & D. Y. Hong, comb. et stat. nov. Basionym: *Syringa yunnanensis* Franchet, Rev. Hort. (Paris) 308. 1891. TYPE: China. Yunnan: Dali, 3000 m, 17 June 1887, *J. M. Delavay 2619* (holotype, P).

Syringa yunnanensis var. *pubicalyx* Z. P. Jien ex P. Y. Bai in Acta Bot. Yunnan. 5: 179. 1983. *Syringa yunnanensis* f. *pubicalyx* (Z. P. Jien ex P. Y. Bai) M. C. Chang, Invest. Stud. Nat. 10: 35. 1990. TYPE: China. Yunnan:

Shangri-La (Zhongdian), Haba, 3200 m, 1 June 1937, *T. T. Yu 11483* (holotype, KUN).

Leaves elliptic, ovate to obovate, (1.8–)2.8–9(–10) × (0.7–)1.3–4.1(–4.9) cm, usually glabrous, rarely pubescent. Inflorescences 7–26 × (2–)2.6–14(–22) cm; rachises lenticellate. Calyx usually glabrous, rarely pubescent, 1–3 × 1–2 mm; corolla tube usually funnelform, (3.5–)4.6–8.5(–10) mm, corolla base 0.6–1.5 mm diam., corolla throat (1–)1.6–2.8(–3) mm diam.; corolla lobes 2–3.6(–4.5) × 1–2(–2.5) mm; anthers 0–1(–2) mm below corolla throat, rarely 0.3–1 mm above throat. Capsule usually oblong, 12–20 × 3–7 mm, smooth to lenticellate.

Distribution, habitat, and phenology. *Syringa tomentella* subsp. *yunnanensis* is distributed in western Sichuan, northwestern Yunnan, and southeastern Xizang in China, growing in forests, forest margins, or open thickets, at altitudes from 2600–3700 m. Observed as flowering in June.

Representative specimens examined. CHINA. **Sichuan:** Daocheng, *Z. G. Liu 625* (CDBI); Derong, *Qinghai-Tibet Exped. 3185* (PE); Muli, *Fliegner et al. 1155* (K), *J. F. Rock 18058* (K), *J. F. Rock 23767* (E), *Qinghai-Tibet Exped. 14204* (PE), *Q. S. Zhao et al. 4561* (CDBI); Yanyuan, *H. F. Handel-Mazzetti 559* (E), *Qinghai-Tibet Exped. 12482* (PE). **Yunnan:** Dali, *H. C. Wang 4750, 4780* (PE); Deqen, *T. T. Yu 8545* (PE); Heqing, *R. C. Ching 23916* (KUN, PE); Lijiang, *D. Chamberlain et al. 138* (E), *R. C. Ching 30209, 30850* (KUN), *A. L. Zhang 100316* (KUN), *S. Zhou 1048* (KUN); Shangri-La, *J. Y. Chen 04189, 04204* (PE), *T. T. Yu 11463, 11986* (PE); Weixi, *Q. W. Wang 63752, 63935* (PE); Yangbi, *Jinshajiang Exped. 4345* (PE). **Xizang:** Bomi, *Tibet Exped. 0562* (HNWP); Tsarung, *J. F. Rock 23180* (E); Zayu, *Qinghai-Tibet Exped. 73376* (PE).

1c. Syringa tomentella subsp. **sweginzowii** (Koehne & Lingelsheim) Jin Y. Chen & D. Y. Hong, comb. et stat. nov. Basionym: *Syringa sweginzowii* Koehne & Lingelsheim, Repert. Spec. Nov. Regni Veg. 8: 9. 1910. TYPE: Fig. 8A in Koehne, Mitt. Deutsch. Dendrol. Ges. 19: 112. 1910 (lectotype, designated here, Koehne, 1910: fig. 8A).

Syringa tetanoloba C. K. Schneider, Pl. Wilson. (Sargent) 1: 299. 1912. TYPE: China. Sichuan: Songpan, 3600–4000 m, Aug. 1910, *E. H. Wilson 4569* (holotype, A).

Syringa tigerstedtii Harry Smith, Lustgården 28–29: 107. 1948. TYPE: China. Sichuan: Danba, Maoniu, 3000 m, 1 Oct. 1934, *H. Smith 12649* (holotype, UPS; isotypes, A, E).

Syringa wilsonii C. K. Schneider, Pl. Wilson. (Sargent) 1: 300. 1912. Syn. nov. TYPE: China. Sichuan: Kangding [Tachien-lu], 2500–3300 m, June & Oct. 1908, *E. H. Wilson 1273* (holotype, A not seen; isotypes, E, K, PE).

Leaves elliptic, lanceolate to ovate, (2.2–)2.5–7.5(–8.5) × (1.4–)1.7–3.9(–4.4) cm, usually glabrous adaxially and glabrous to pubescent abaxially. Inflorescences 6–30 × (2.5–)2.7–11.2(–12) cm; rachises lenticellate, pubescent to glabrous. Calyx usually glabrous, 1–3 × 1–2 mm; corolla tube usually cylindrical, (4–)5.1–10.3(–11) mm, corolla base 0.6–1.5 mm diam., corolla throat (1–)1.3–2.4(–3) mm diam.; corolla lobes elliptic to triangular, (2–)2.6–4.6(–5) × (0.8–)1–1.9(–2) mm; anthers 0.5–2(–3) mm below corolla throat. Capsule oblong to conical, 10–20 × 3–5 mm, smooth to lenticellate.

Distribution, habitat, and phenology. *Syringa tomentella* subsp. *sweginzowii* is distributed in Sichuan and Xizang provinces in China, growing in forests, forest margins, valleys, or on open slopes, at altitudes from 2400–4200 m. Observed as flowering in June.

Discussion. Since Koehne and Lingelsheim (1910) described *Syringa sweginzowii* from a cultivated plant and did not designate any type specimen for it, we designate here Koehne's (1910: fig. 8A) figure as the lectotype of *S. sweginzowii* in accordance with the *International Code of Botanical Nomenclature* (Greuter et al., 2000: Art. 9.2, 9.13).

Syringa wilsonii resembles *S. sweginzowii* with respect to the indumentum on leaves, inflorescences, and calyces. In contrast, *S. wilsonii* is closely related to *S. tomentella* in the shape of the corolla tube and the position of anthers inserted at the corolla tube. It represents a morphological transition from *S. tomentella* to *S. sweginzowii*. Chang (1992) and Chang et al. (1996) treated *S. wilsonii* as a synonym of *S. tomentella*, but our multivariate analysis (Chen, unpublished data) suggests that *S. wilsonii* more closely resembles *S. sweginzowii* and is better treated as a synonym of *S. tomentella* subsp. *sweginzowii*.

Representative specimens examined. CHINA. **Sichuan:** Barkam, *X. Li 71160, 71231* (PE), *W. L. Chen 7564* (PE); Dajin, *X. Li 76293, 77310* (PE); Daocheng, *Z. G. Liu 0025* (CDBI); Dege, *Y. W. Tsui 5130* (PE); Garze, *W. L. Chen 6775, 7231* (PE); Heishui, *X. Li 73125, 73995* (PE); Jiulong, *Anonymous 20080* (CDBI); Kangding, *J. A. Soulie 563* (P), *M. D. Liu & Z. G. Liu 4771* (CDBI, PE), *Y. Z. Chen et al. 112917* (SZ); Lixian, *J. Y. Chen 04153, 04162* (PE), *W. G. Hu 53415, 53650* (PE), *D. P. He 44228, 44306* (PE); Liuba, *C. R. Lancaster 934* (K); Luhuo, *Q. S. Zhao et al. 111253* (PE, SZ); Muli, *Y. B. Yang 7138* (CDBI), *Q. S. Zhao et al. 6811* (CDBI); Serta, *S. Jiang 9095* (PE); Songpan, *Berezovski s.n.* (LE), *K. T. Fu 1772, 2003* (PE); Xiangcheng, *J. Dong 28856* (CDBI); Xiaojin, *X. S. Zhang & Y. X. Ren 5847* (CDBI, PE), *7129* (PE); Yajiang, *W. L. Chen 6590* (PE), *S. Jiang 5122* (PE). **Xizang:** Bomi, *B. S. Li & S. Z. Cheng 529* (PE), *R. F. Huang 717, 1029* (HNWP); Jamda, *Qinghai-Tibet Exped. 9915* (PE), *Xizang Exped. 2266* (HNWP); Qamdo, *Qinghai-*

Tibet Exped. 7325 (PE); Zayu, *Qinghai-Tibet Exped. 10346* (PE).

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Ilex guaramacalensis (Aquifoliaceae), a New Species from the Ramal de Guaramacal in the Venezuelan Andes

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ABSTRACT. *Ilex guaramacalensis* Cuello & Aymard (Aquifoliaceae), a new species from the Andean forests and páramos of Guaramacal massif in Venezuela, is described and illustrated, and its morphological relationships with allied species are discussed. *Ilex guaramacalensis* is morphologically similar to *I. kunthiana* Triana from the high mountains of Costa Rica and Panama, the Coastal Cordillera, and the Andes of Venezuela to Peru, but the new species differs by the shape of its young branchlets, leaves, pedicels, and petals; the higher number of secondary veins; the shorter inflorescences; and the 4-merous flowers. Information about the floristic composition and habitat characteristics for the new species is also provided.

RESUMEN. Se describe e ilustra *Ilex guaramacalensis* Cuello & Aymard (Aquifoliaceae), una nueva especie de los bosques Andinos y páramos del Ramal de Guaramacal en Venezuela, y se discuten sus relaciones morfológicas con las especies afines. *Ilex guaramacalensis* es morfologicamente similar a *I. kunthiana* Triana, conocida de las montañas altas de Costa Rica y Panamá, Cordillera de la Costa y de los Andes de Venezuela hasta Perú, sin embargo, la nueva especie se diferencia por la forma de sus ramitas jóvenes, hojas, pedicelos y pétalos, el mayor numero de venas secundarias, las inflorescencias mas cortas y las flores tetrámeras. Se presenta también información sobre la composición florística y características del hábitat donde crece la nueva especie.

Key words: Andes, Aquifoliaceae, *Ilex*, IUCN Red List, páramo, Venezuela.

Ilex L. (Aquifoliaceae) is a genus of dioecious shrubs or trees, with simple, alternate leaves and usually 4- to 5-merous flowers that are organized in cymose inflorescences, with the cymes at times reduced to a single flower (Edwin, 1965, 1967; Loizeau & Spichiger, 1992). Comprising more than 500 species (Loizeau et al., 2007), *Ilex* is distributed mainly in tropical America and eastern Asia, but species have also been recorded from North America, Europe, the Pacific islands, northeastern Australia, and sub-Saharan Africa (Loizeau et al., 2005). The first comprehensive examination of the genus was done by A. Gray (1856; see Galle, 1997), who recognized three subgenera. The German botanist Theodor Loesener later undertook a worldwide revision of the genus (Loesener, 1901, 1908, 1942). He divided the genus into five subgenera including eight series, 24 sections, and 14 subsections. Hu (1949, 1950) subsequently revised the *Ilex* from China based on Loesener's classification and made substantial modifications recombining infrageneric taxa and describing new series and sections. Edwin (1965) established a new section *Guayanoilex*, a group that has included, up to the present, all species endemic to the Guayana highlands. The genus has also been treated for floras of Cuba (González-Gutiérrez & Sierra-Calzado, 2004), Nicaragua (Hahn, 2001), Panama (Edwin, 1967; Hahn, 1993), Peru (Loizeau, 1994), Argentina (Giberti, 1979), Paraguay (Giberti, 1994), and the Flora of the Venezuelan Guayana (Steyermark & Berry, 1995). Nonetheless, recent systematic treatment of the genus is lacking. Galle (1997) published a comprehensive review of all information known about the taxonomy of the genus to date. He contested the validity of Loesener's infrageneric groups, since many of the species bear features shared by several of the subgenera, and about 50 species remain taxonomically undefined within Loesener's classification. The floral morphology is very homogeneous at an interspecific level, while leaf morphology can show great variability at this same level (Loizeau et al., 2005). Moreover, many taxa were described only with fruiting material or only with either staminate or pistillate specimens (Edwin, 1965; Steyermark, 1988). This situation has tended to overestimate the diversity of *Ilex*, however; for a dioecious genus like *Ilex*, it is always recommended to have sufficient additional material collected before describing a new species.

During the past 20 years, integrated surveys by personnel of the Herbario Universitario (PORT), Universidad Nacional Experimental de los Llanos

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Occidentales "Ezequiel Zamora" (UNELLEZ)-Guanare, in the cloud forests and páramo vegetation of the Guaramacal National Park, in the Andes of Trujillo state, Venezuela (Ortega et al., 1987; Cuello, 1999, 2000, 2002, 2004; Dorr et al., 2000), have revealed a number of new plant species to science (Morillo, 1988; Axelius & D'Arcy, 1993; Carnevali & Ramírez, 1998; Aymard et al., 1999; Taylor, 2002; Stergios & Dorr, 2003; Stančik, 2004; Niño et al., 2005). More recent vegetation surveys have uncovered a previously undescribed species of the genus *Ilex*. Sterile material had been collected many times in the surveys but could not be matched to any known species of *Ilex*. Upon the finding of fertile material (staminate and pistillate flowers and fruits), the specimens were at first determined as *Ilex* cf. *kunthiana* Triana based on its similar leaves and 1-flowered pistillate inflorescences. However, a detailed study of specimens available in GH, NY, U, and VEN and the literature on *Ilex* revealed that these specimens represent a new species.

With the new species described below, this genus now includes 83 species for Venezuela, 54 of which are endemic (Loizeau & Barriera, 2008); eight taxa are present in the Venezuelan Andes and only four of them (*Ilex guaramacalensis* Cuello & Aymard, *I. kunthiana*, *I. myricoides* Kunth, *I. truxillensis* var. *bullatissima* Cuatrecasas) are known from Venezuelan páramos. *Ilex pernervata* Cuatrecasas, known from Mérida state (Loizeau & Barriera, 2008), could also be present in páramo areas.

Ilex guaramacalensis Cuello & Aymard, sp. nov. TYPE: Venezuela. Trujillo: Mun. Boconó, Parque Nac. Guaramacal, bosque de 8–10 m de alto, sobre lomas adyacentes a las lagunas del Páramo El Pumar, Parcela No. 35, UTM 368063 E, 1018977 N, 2890 m, 16–17 Feb. 2005 (♀ fl., fr.), *N. Cuello, W. Albarrán, L. Linares, R. Caracas, L. Zambrano y P. Tovar 2771* (holotype, PORT; isotypes, US, VEN). Figure 1.

Species proxima *Ilici kunthianae* Triana, sed differt vero: ramulis junioribus teretibus, dense trichomatibus albis strigosis obductis, foliis ellipticis vel late ellipticis, subtus sparse strigoso-pubescentibus vel pilosulis, venis utrinque 5 ad 6 paribus; inflorescentiis pistillatis 1.5–2(–3) mm longis, sparse strigoso-pubescentibus, pedicellis teretibus, floribus 4-meris, calycis lobis extus adpresse pubescentibus, petalis lobis oblongis, 1.5–2 mm longis, margine crosis.

Shrub to small tree, 2.5–10(–15) m tall; trunk 2.5–40 cm DBH, densely branched; branches sparsely strigose-pubescent, glabrous when mature; young branchlets terete, densely covered by white strigose trichomes; stipules narrowly lanceolate, acute, stiff, glabrous, 0.8–1.2 mm long, ca. 0.5 mm wide at the base, persistent. Leaves coriaceous, glabrous, shiny adaxially, punctate and sparsely strigose-pubescent to pilosulose abaxially (the pubescence denser at the base and along midnerve), elliptic to widely elliptic, 1–3 × 0.8–1.5 cm, the base and apex obtuse to rounded, margin revolute and crenulate, 5 to 7 pairs of teeth, 0.2–0.3 mm, apically glandulous or slightly mucronate, 2–3 mm distant; midnerve sulcate adaxially, prominent abaxially; lateral veins in 5 to 6 pairs, anastomosing near margin, impressed adaxially, slightly elevated abaxially; tertiary venation impressed adaxially, inconspicuous abaxially; petioles (1–)2–3(–4) mm, glabrous. *Staminate inflorescences* solitary cymes, axillary, 1- to 3-flowered, 4–6 mm, sparsely strigose-pubescent. *Pistillate inflorescences* solitary cymes, axillary, 1-flowered, 1.5–2(–3) mm, floral bracteoles 2, triangular, 0.5–1 mm, strigose at the base. *Flowers* 4-merous; pedicels terete, sparsely strigose-pubescent, 1–2(–3) mm; calyx lobes suborbicular to rounded, obtuse, externally appressed-pubescent, glabrous inside, ciliate on the margins, 1–1.5 × 1–2.5 mm; corolla white, glabrous, 2–2.5(–3) mm, petals connate at the base, oblong, rounded at apex. *Staminate flowers* with a yellowish green conical pistillode, ca. 1 × 0.5 mm; petal lobes ca. 1.5 mm, margins entire; stamens 4, alternate with the petals, epipetalous, ca. 2 mm; anthers sagittate, yellowish purple, longitudinally dehiscent, 0.6–1 × 0.5–0.6 mm, filament white, 0.5–1 mm. *Pistillate flowers* with a pyriform pistil; ovary 4-carpellate, 1.5–2 × 1–1.2 mm, stigma capitate, ca. 0.5 × 1.2 mm; petal lobes 1.5–2 mm, margins erose; staminodes 4, white, epipetalous, alternate to lobes, ca. 2 mm; sterile anthers flattened, sagittate. *Fruit* globose, yellowish green when mature, 4–5 mm diam.; mesocarp fleshy; stigma persistent, capitate; pyrenes 1 to 4 per fruit, beige to translucent, fusiform or 2-angled, the angles rounded, dorsally convex, 3–4 × 1.5–2 mm; seed brown, 1.8–2 × 1–1.5 mm.

Distribution and ecology. *Ilex guaramacalensis* is so far endemic to Venezuela and known only from the subpáramo, páramo, and Andean forests from 2750–3100 m on the highest reaches of the Guaramacal massif in Trujillo state. The forests where this species appears can be classified as upper montane rainforest and subalpine rainforest (UMRF, SARF, sensu Grubb, 1977) or Andean and high Andean forest (according to Cuatrecasas, 1934). The specific forest community is an association of *Geissanthus andinus* Mez and *Miconia jahnii* Pittier (Cuello & Cleef, in press). *Ilex guaramacalensis* is found as a relatively dominant species in the canopy layer or as an emergent tree. These forests have a low stature from 5–12 m, evergreen, with a notable litter layer, and are character-

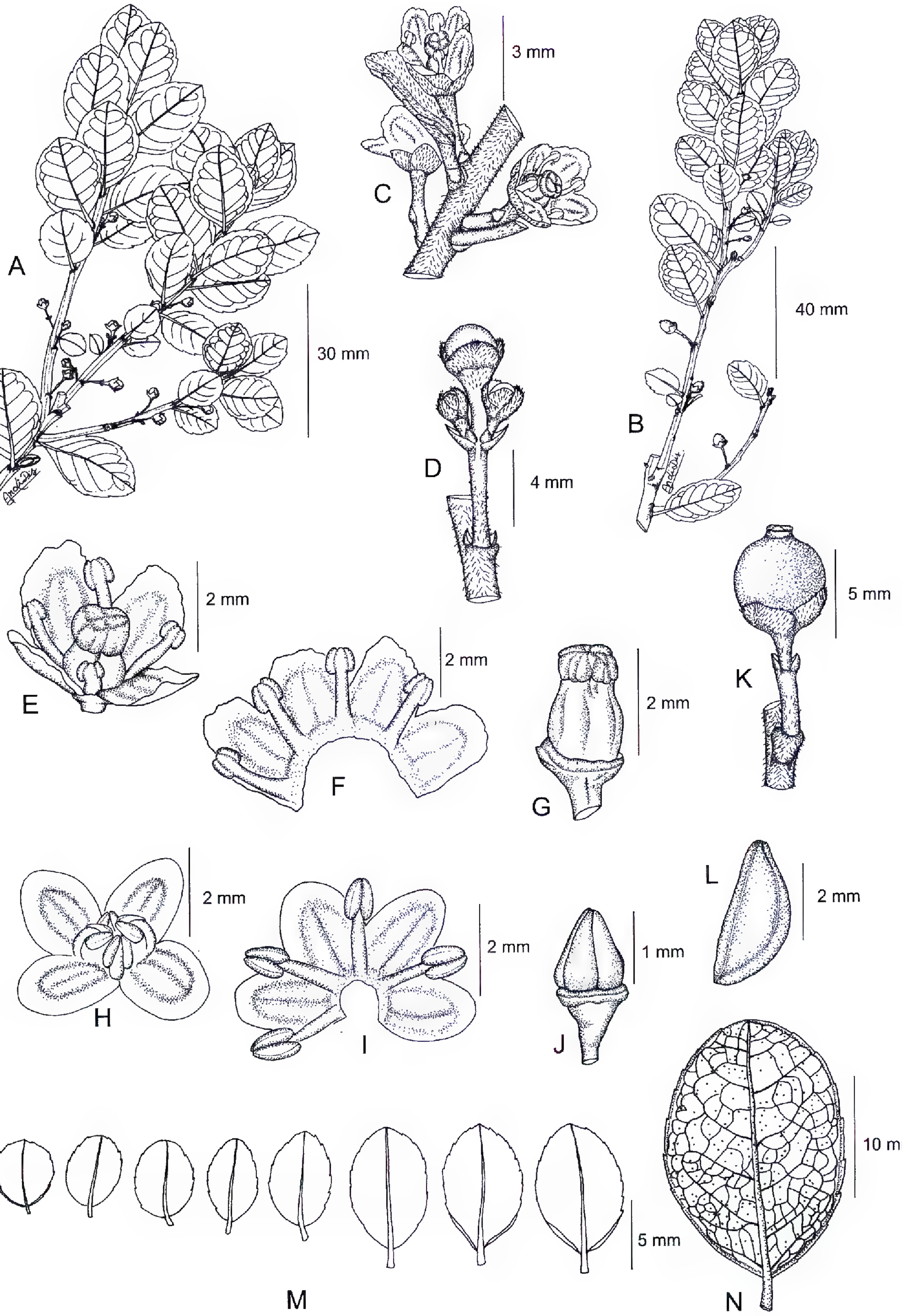

Figure 1. *Ilex guaramacalensis* Cuello & Aymard. —A. Staminate flowering branch. —B. Pistillate flowering branch. —C. Pistillate inflorescence showing bracts and bracteoles. —D. Staminate inflorescence bud. —E. Pistillate flower. —F. Corolla and staminodes. —G. Pistil. —H. Staminate flower. —I. Corolla and stamens. —J. Pistillode. —K. Fruit. —L. Lateral view of a pyrene. —M. Leaf shapes and sizes. —N. Detail of leaf venation. A, D, H–J, based on *Cuello et al. 2701*; B, based on the type *Cuello et al. 2771*; C, E–G, K, L, based on *Cuello et al. 2942*; M and N, based on *Cuello et al. 2701*, *2771*, *2942*.

ized by an almost permanent cloudiness and an extraordinary density of epiphytic mosses and liverworts. The most common tree species growing together with *I. guaramacalensis* in these forests are *Cybianthus marginatus* (Bentham) Pipoly, *G. andinus*, *Hesperomeles obtusifolia* (Person) Lindley, *M. jahnii*, *M. tinifolia* Naudin, *Myrsine dependens* (Ruiz & Pavón) Sprengel, *Oreopanax discolor* Decaisne & Planchon, *Symplocos tamana* Steyermark, *Vaccinium corymbodendron* Dunal, and *Weinmannia lechleriana* Engler.

Ilex guaramacalensis also appears scattered as dwarf trees in the humid shrub páramo association of *Disterigma acuminatum* (Kunth) Niedenzu and *Arcytophyllum nitidum* (Kunth) Schlechtendal (Cuello & Cleef, in prep.) growing together with other dwarf trees or shrubs up to 3 m tall such as *Chaetolepis lindeniana* (Naudin) Triana, *Hypericum juniperinum* Kunth, *Palicourea jahnii* Standley, and *Ugni myricoides* (Kunth) O. Berg; along with the stem rosettes *Blechnum schomburgkii* (Klotzsch) C. Christensen, *Ruilopezia paltonioides* (Standley) Cuatrecasas, and *R. lopez-palacii* (Ruiz-Terán & López-Figueiras) Cuatrecasas; the dwarf shrubs *Disterigma acuminatum* (Kunth) Niedenzu, *D. alaternoides* (Kunth) Niedenzu, *Hypericum cardonae* Cuatrecasas, *H. paramitanum* N. Robson, and *Pernettya prostrata* (Cavanilles) DC.; the big ground rosette *Puya aristeguietae* L. B. Smith; tussocks of *Cortaderia hapalotricha* (Pilger) Conert; and the bamboos *Chusquea angustifolia* (Sodestron & C. E. Calderón) L. G. Clark and *Neurolepis glomerata* Swallen.

It seems that in perhumid climates, *Ilex* species are common in high Andean forests and shrubby páramo. In the rainy massif of Tatamá in the Colombian Western Cordillera, at least six different *Ilex* species have been documented (Rangel et al., 2005). In the rainy massif of Guaramacal, to date, in addition to *I. guaramacalensis*, *I. myricoides* and *I. truxillensis* var. *bullatissima* are found in the Andean forests, while *I. laurina* Kunth and two additional undetermined species are found in the subandean forests (Dorr et al., 2000; Cuello & Cleef, in press).

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), the new species should be included in the category Least Concern (LC) at the regional level because it is legally protected within the borders of the Guaramacal National Park and numerous individuals are frequently found in the area. According to our field data, at least 60 mature individuals of *Ilex guaramacalensis* were recorded in 0.455 ha. of surveyed upper montane forests within the area of Guaramacal National Park (Cuello & Cleef, in press).

Phenology. *Ilex guaramacalensis* has been collected in flower and in fruit from January to April.

Relationships. In accordance with the inflorescence classification proposed by Loizeau and Spichiger (1992), this new species belongs to the group with a solitary dichasium. By its small leaves (ca. 3 cm long), crenulate margins, lateral anastomosing nerves, and pistillate, 1-flowered inflorescences, *Ilex guaramacalensis* is morphologically similar to *I. kunthiana* from the Andes of Venezuela to Ecuador (Luteyn, 1999; Jørgensen & León-Yánez, 1999) and from the high mountains of Costa Rica and Panama (W^3FM). However, *I. guaramacalensis* differs from *I. kunthiana* by its terete young branchlets densely covered by white strigose trichomes (vs. quadrangular, glabrous young branchlets); elliptic to rounded leaves that are sparsely strigose-pubescent to pilosulose abaxially (vs. leaves glabrous on both sides) and have five or six pairs of lateral veins (vs. three or four pairs); axillary pistillate inflorescences (vs. opposed pistillate inflorescences), 1.5–2 mm long (vs. 8–10 mm long), and sparsely strigose-pubescent (vs. glabrous); terete pedicel (vs. 4-angled); 4-merous flowers (vs. 5-merous); externally appressed pubescent calyx lobes (vs. glabrous outside); and oblong petal lobes with erose margins, 1.5–2 mm long (vs. ovate with entire margins, 3–3.5 mm long).

Paratypes. VENEZUELA. **Trujillo:** Mun. Boconó, Parque Nac. Guaramacal, páramo de Guaramacal, alrededores de las antenas, UTM 369782 E, 1020835 N, ♂ fl., *N. Cuello, W. Albarrán, L. Linares, R. Caracas y L. Zambrano 2701* (G, MO, PORT, US, VEN), ♀ fl./fr., *N. Cuello, W. Albarrán y M. Valladares 2942* (NY, PORT, VEN); páramo "El Pumar," parcela No. 34, UTM 369585 E, 1020286 N, *N. Cuello, W. Albarrán, L. Linares, R. Caracas y L. Zambrano 2683* (MER, PORT, VEN), parcela No. 36, UTM 368111 E, 1018943 N, *N. Cuello, W. Albarrán, R. Caracas, P. Tovar y L. Zambrano 2798* (MERC, PORT); bosques remanentes cerca de la carretera hacia las antenas, vertiente N, parcela No. 39, UTM 369545 E, 1021382 N, ♂ fl., *N. Cuello, W. Albarrán, L. Zambrano y M. Valladares 2853* (PORT, VEN).

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Draba simmonsii (Brassicaceae), a New Species of the *D. micropetala* Complex from the Canadian Arctic Archipelago

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ABSTRACT. *Draba simmonsii* Elven & Al-Shehbaz (Brassicaceae), a new species from the Canadian Arctic Archipelago, is described and illustrated. Its taxonomic history, distribution, habitats, and distinguishing characters from the closely related *D. micropetala* Hooker and *D. pauciflora* R. Brown are discussed. The IUCN status of the new species is determined as Least Concern (LC). *Draba simmonsii* is based on *D. alpina* L. var. *gracilescens* Simmons, which is lectotypified.

Key words: Arctic Archipelago, Brassicaceae, Canada, *Draba*, IUCN Red List.

The *Draba micropetala* Hooker complex, recognized by Tolmatchew (1939, 1975) as series *Oblongatae* Tolmatchew, has been considered to include two high arctic species: *D. pauciflora* R. Brown (= *D. adamsii* Ledebour) and *D. micropetala* (or *D. oblongata* auct., non *D. oblongata* R. Brown ex DC.). These species are characterized by very small (2–3 × 0.7–1.5 mm), suberect, pale yellow or reddish yellow petals scarcely longer than the 1.8–2.5 mm long sepals and with nearly parallel margins; fruits pubescent primarily with simple trichomes; subsessile stigmas on styles 0.05–0.2(–0.3) mm long; and basal leaves ciliate with stout, simple and/or branched trichomes. *Draba pauciflora* differs from *D. micropetala* by its subacute (vs. obtuse or rounded) leaves with simple and forked (vs. predominantly cruciform) marginal and surface trichomes; non-elongating (vs. elongating) infructescences with straight (vs. somewhat flexuous) rachis; pale reddish yellow (vs. pale yellow) petals; and obovate-oblong (vs. elliptic to elliptic-ovate), olive-brown (vs. grayish green), and subglabrous (vs. moderately to densely) pubescent fruits (see key). The two species differ in ploidy levels: *D. pauciflora* is tetraploid with $2n = 32$ reported from Wrangel Island, Russia (Zhukova et al., 1973; Zhukova & Petrovsky, 1984), Alaska, U.S.A. (Packer & McPherson, 1974; Mulligan, 1974), and Svalbard, Norway (Brochmann et al., 1993); *D. micropetala* is hexaploid with $2n = 48$ reported from Wrangel Island (Petrovsky & Zhukova, 1981; Zhukova & Petrovsky, 1984) and Svalbard (Brochmann et al., 1993).

Some names have been misapplied in North America and elsewhere in this group. The most consistent misapplication, and the one of concern here, is that of *Draba oblongata*. This name was nearly uniformly applied for *D. micropetala* (or for a collective species concept of *D. micropetala*, *D. pauciflora*, and the new species described below as *D. simmonsii* Elven & Al-Shehbaz). However, Mulligan (1974) showed that the type of the name *D. oblongata* belongs to a white-flowered species with minute stellate hairs, with affinities to *D. cinerea* Adams, and that this name replaces the later-published *D. groenlandica* E. Ekman (Ekman, 1930). Mulligan (1974) also identified the holotype of *D. micropetala* (Canada. Nunavut: Igloolik Island, *Parry s.n.* [K]). We have inspected this type and confirm Mulligan's conclusion. *Draba pauciflora* was also described from Canada (Nunavut, Bylot Island), but its type, which should be at K, was not found when looked for in the 1990s and again in 2006. The name may need to be re-typified, although its application has not been ambiguous.

Both *Draba micropetala* and *D. pauciflora* are distributed in Canada (Nunavut, Northwest Territories), Greenland, northern Norway, and Russia (Arctic Russia, Siberia, and Far East), and both also occur rarely in northern Alaska; they exhibit some variation throughout their vast distributional range. However, during the revision by one of us (Elven) of *Draba* at CAN and DAO in 2003 for the *Flora of the Canadian Arctic Archipelago* (Aiken et al., 2007), it became clear that only a part of the material of the complex fits well into the two species. The larger part differed from both species in several characters, especially flower size (see below), that justify recognition of a new species: *D. simmonsii*. Plants of the new species

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have been recognized previously as different, but have been misunderstood. Simmons (1906: 83, pl. 6, fig. 1–3) described and illustrated the taxon from Ellesmere Island as a new variety, *D. alpina* L. var. *gracilescens* Simmons, and deposited numerous vouchers at O and elsewhere. That variety was maintained by Schulz (1927). Porsild (1955: 127–129, pl. XVII) presented a good description of this entity, with illustration, but under the name *D. oblongata*. As this was the first comprehensive description made under this name, it served for the misapplication of this name in later works.

Draba simmonsii Elven & Al-Shehbaz, nom. et stat. nov. Replaced name: *Draba alpina* L. var. *gracilescens* Simmons, Vasc. Pl. Ellesmereland 83. 1906. TYPE: Canada. Ellesmere Island: Goose Fiord, 76°29′N, 88°40′W, 20 July 1901, *Herman G. Simmons 2888* (lectotype, designated here, O; isotype, O). Figure 1.

Herba perennis scaposa, (1.5–)3–11(–13) cm alta. Folia basalia rosulata, oblonga vel oblongo-lanceolata, 5–16 × 2–5 mm, ciliata, pilis, simplicibus ad 1 mm longis et subdendritis minoribus praeditis; folia caulina nulla. Racemi ebracteati, (2)4- ad 10(14)-flori, rhachidibus rectis; pedicelli fructiferi 2.5–10 mm longi. Sepala oblonga, (2.5–)2.8–3.5(–3.8) mm longa; petala pallide flava, anguste obovata, emarginata, (3.5–)3.8–5.5(–5.8) × (2.5–)2.8–4(–4.6) mm. Fructus lanceolati, 5.5–9(–11) × 2.3–3.8 mm, compressi, pilis simplicibus; stylo 0.1–0.3 mm longo; ovula 16 ad 24(28). Semina oblongo-ovata, 1–1.3 × 0.7–0.8 mm.

Perennial herb, scapose; caudex few- to many-branched, with persistent remains of leaf bases and petioles; stems (1.5–)3–11(–13) cm, simple, pubescent throughout with stalked, 2- to 4-rayed and fewer simple trichomes, 0.1–0.3(–0.6) mm, sometimes sparsely pubescent distally. Basal leaves rosulate, not imbricate, oblong to oblong-lanceolate, 5–16 × 2–5 mm, entire, subacute to obtuse; abaxial surfaces pubescent with a mixture of simple and stalked, 2- to 4(to 6)-rayed, stellate to subdendritic trichomes, rarely glabrous; adaxial surfaces glabrous or pubescent; petiole base somewhat thickened, persistent, margin ciliate with simple trichomes 0.5–1 mm; cauline leaves absent. Racemes ebracteate, (2)4- to 10(14)-flowered, slightly elongating in fruit; rachis pubescent as stem, straight; lowermost fruiting pedicels 2.5–10 mm, divaricate, straight, pubescent as stem. Flowers: sepals oblong, (2.5–)2.8–3.5(–3.8) mm, purplish green, with simple and sometimes fewer, short-stalked, 2-rayed trichomes; petals pale yellow, narrowly obovate, emarginate, (3.5–)3.8–5.5(–5.8) × (2.5–)2.8–4(–4.6) mm, with non-parallel sides; stamens 2–3 mm; anthers ovate, ca. 0.5 mm. Fruits lanceolate, 5.5–9(–11) × 2.3–3.8 mm, slightly flattened, not twisted, pubescent with simple and sometimes fewer, 2-rayed trichomes, 0.1–0.3 mm; style 0.1–0.3 mm; stigma as wide as style; ovules and seeds 16 to 24(to 28) per fruit; seeds oblong-ovate, flattened, dark brown, 1–1.3 × 0.7–0.8 mm, wingless.

Distribution and IUCN Red List category. *Draba simmonsii* is widespread in the Canadian Arctic Archipelago, having been recorded from all major islands from Ellesmere, Devon, and Baffin islands, westward to Victoria, Banks, and Prince Patrick islands. In the Canadian arctic islands, this species constitutes more than one third of the total collections of the *D. micropetala* complex, giving *D. simmonsii* an IUCN conservation status of Least Concern (LC) (IUCN, 2001). It is uncertain whether the species occurs outside the Canadian Arctic Archipelago and western Greenland. We have seen no specimens of *D. simmonsii* from Yukon Territory, Alaska, or Eurasia. Its northernmost occurrence on the Canadian mainland is from Cape Bathurst, east of the Mackenzie River. All three species of the *D. micropetala* complex (*D. micropetala*, *D. pauciflora*, *D. simmonsii*) appear to be exclusively arctic; we are not aware of any reports from south of the arctic forest line.

Habitat. *Draba simmonsii* occurs mostly on dry, open ground with sparse or open vegetation or on open patches in fresh to dry closed meadow or heath vegetation. The substrate varies from gravel to silt. It is also found on outwash plains but never in very wet sites. Several sites are known on upper (non-saline) parts of shores. Most sites have circumneutral to basic substrates and, like *D. micropetala*, *D. simmonsii* seems to be largely absent from regions with acidic substrates (e.g., most of Baffin Island). Snow cover is probably scarce to moderate, and it is among the earliest-flowering *Draba* species (Elven, pers. obs.). Nearly all collections are past anthesis, even though several have been collected in early July in the High Arctic (Ellesmere Island). In its ecological preferences, *D. simmonsii* resembles *D. micropetala*; *D. pauciflora* mostly occurs in different sites: moist to wet, mossy, and cold, often with permanent or frequent seepage and well snow-covered. *Draba simmonsii* is slightly more frequent than *D. micropetala* and *D. pauciflora* in regions with acidic substrates. The differences in habitats between the three species are more pronounced in the southern and middle parts of the Arctic; in the climatic Polar Desert they occur together in patches of vascular plant vegetation.

Phenology. Flowering late June through July; fruiting mid-July to August.

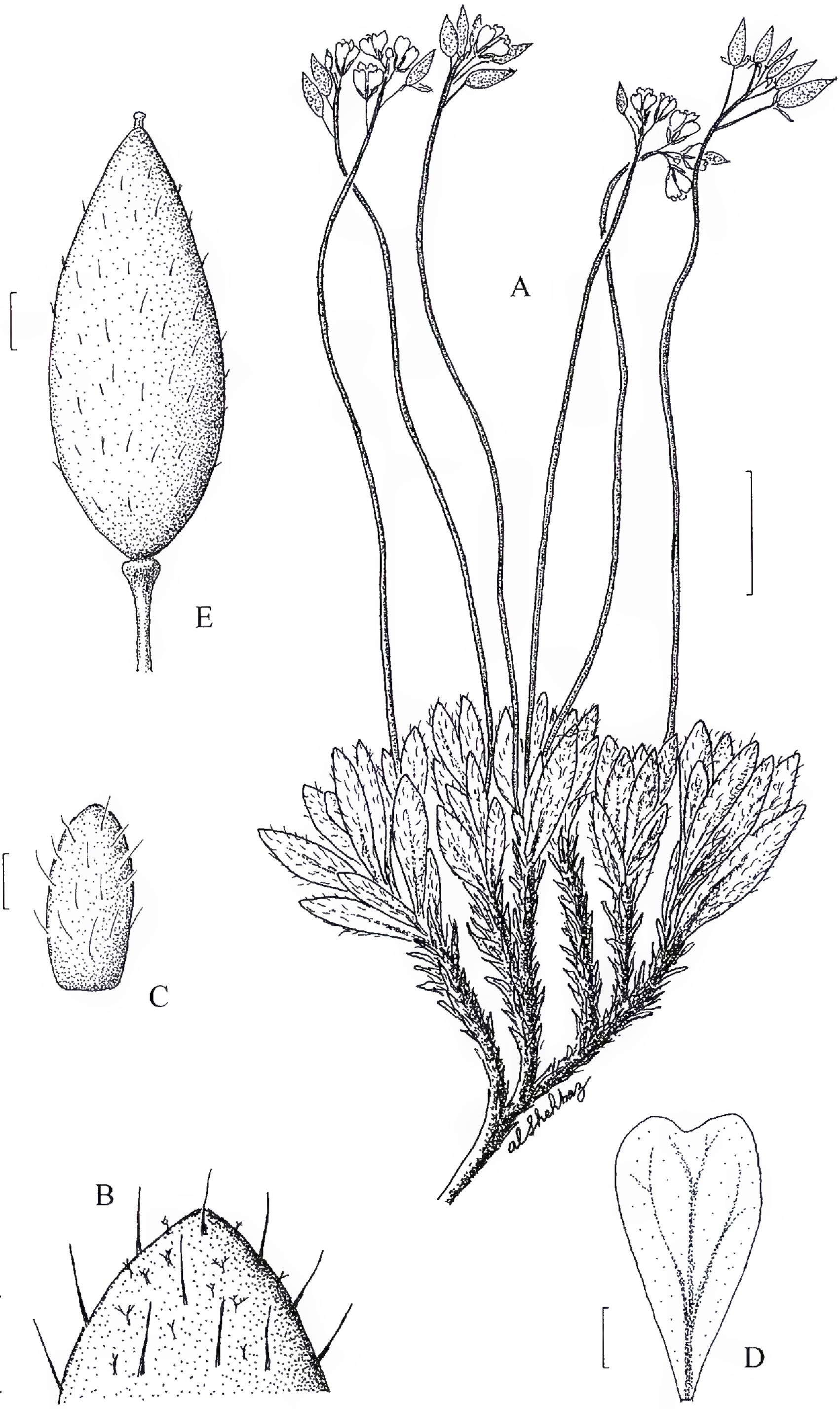

Figure 1. *Draba simmonsii* Elven & Al-Shehbaz. —A. Plant. —B. Abaxial side at leaf apex. —C. Sepal. —D. Petal. —E. Fruit. Drawn by Ihsan A. Al-Shehbaz from the holotype, *Simmons 2888* (O). Scale bars: A = 1 cm; B = 5 mm; C–E = 1 mm.

Discussion. *Draba simmonsii* is named in honor of Herman Georg Simmons (1866–1943), who collected it extensively on Ellesmere Island and recognized it as *D. alpina* var. *gracilescens* (Simmons, 1906). It was previously confused with *D. micropetala* and *D. pauciflora*, but can be readily distinguished from these by having narrowly obovate (vs. narrowly oblanceolate), distinctly larger ([3.5–]3.8–5.5[–5.8]

× [2.5–]2.8–4[–4.6] mm vs. 2–3 × 0.7–1.5 mm), pale yellow petals with non-parallel (vs. parallel) margins; longer sepals ([2.5–]2.8–3.5[–3.8] mm vs. 1.8–2.5 mm long); lanceolate (vs. obovate-oblong [*D. pauciflora*] or elliptic to elliptic-ovate [*D. micropetala*]) fruits; and primarily simple and subdendritic (vs. forked or stellate with some simple) trichomes on the subapical abaxial leaf surface. From *D. micropetala*, *D. simmonsii* also differs by having straight (vs. flexuous) rachis of infructescence, purplish green (vs. green) sepals, oblong to oblong-lanceolate (vs. obovate to oblanceolate) leaves, and slightly broader seeds (0.7–0.8 mm vs. 0.5–0.6 mm wide). From *D. pauciflora*, the new species also differs by having an elongating (vs. non-elongating) infructescence, fruits widest at or below (vs. above) middle, and pale yellow (vs. pale reddish yellow) petals (see key).

Simmons (1906: 85) listed 16 collections, all at O, under *Draba alpina* var. *gracilescens*, of which two were cited as the types: "Goose Fjord, below the Falcon Cliff (2888, 4007, type specimens of the description)." The two sheets of *Simmons 2888* have flowers and fruits, whereas the single sheet of *Simmons 4007* is fragmentary. The designation herein of *Simmons 2888* as the lectotype of both *D. simmonsii* and var. *gracilescens* would ensure that the two names remain together.

Paratypes. CANADA. **Nunavut:** Axel Heiberg Island, above Bukken River headwaters, 80°31′N, 92°3′W, *L. J. Gillespie, L. R. Consaul & R. Soreng 6605* (O); Port Hendrigan, *Beschel 12822* (CAN); Flag Hill, vic. of Upper House, *M. Kuc 325* (CAN). Baffin Island, Erik Harbour, 72°40′N, 76°30′W, *B. Boivin 1948* (DAO). Bathurst Island, Stuart River Valley, 76°14′N, 99°08′W, *W. Blake 47i* (DAO); Bracebridge Inlet, 75°09′N, 99°44′W, *J. S. Tener & C. R. Harington 47* (CAN). Cornwallis Island, Resolute Bay, 1/4 mi. W of Weather Station, *H. B. Collins 148* (CAN). Devon Island, SE side of Crocker Bay, 74°32′N, 82°47′W, *R. Elven 3351/99* (ALA, O), *R. Elven 3152/99* (O), *R. Elven 3275/99* (O). Victoria Island, Cambridge Bay, *J. A. Calder, D. B. O. Savile & I. Kukkonen 24211B* (DAO). Ellesmere Island, betw. Muskox Fiord & Baad Fiord, 76°30–31′N, 86°46′W, *R. Elven 3073b* (ALA, O), *R. Elven 3095/99* (O), *R. Elven 3115/99* (ALA, O), *R. Elven 3131b/99* (O); near Cape Violet, *H. G. Simmons 1742* (O); Goose Fiord, Gallow Point, *H. G. Simmons 4209* (O); Hayes Sound, Eskimopolis, *H. G. Simmons 846* (O); Goose Fiord, near Ptarmigan Gorge, 76°48′N, 88°40′W, *H. G. Simmons 4210* (O); Fram Harbor, *H. G. Simmons 1205* (O), same area, *H. G. Simmons 1096* (O). Bedford Pim Island, 78°4′N, 74°50′W, East Ellesmere Island, *H. G. Simmons 4187, 4192* (O); Ekblaw Lake, 81°37′N, 75°30′W, *D. F. Murray & B. A. Yurtsev 10295* (ALA). Skräling Island, Alexandra Fiord, E Ellesmere Island, 78°53′N, 75°50′W, *H. G. Simmons 4196* (O); Ravine Bay, *S. D. MacDonald 37* (CAN); Eureka, 80°03′N, 85°31′W, *P. F. Bruggemann 566* (DAO); vic. of Lake Hazen, E side of Gilman Glacier, 81°45′–82°10′N, 68°30′–72°45′W, *J. M. Powell 698* (CAN). Ellef Ringnes Island, W side of Reindeer Peninsula, 78°55′N, 104°38′W, *R. Elven 3002/99* (O), *R. Elven 3040/99* (ALA, O); Isachsen, 78°47′N, 103°33′W, *D. B. O. Savile 4231* (DAO). Anderson River area, Cape Bathurst, 70°29′N, 127°48′W, *R. Elven 2401/99* (ALA, O). King Christian Island, 12 km W of Cape Abernathy, 77°45′N, 101°25′W, *E. H. Hamilton T654* (DAO). Melville Island, NE of head of Beverley Inlet, 75°06′N, 107°38′W, *R. Elven 2965/99* (ALA, O); Murray Inlet, 75°28′N, 113°09′W, *S. A. Edlund 337* (CAN); E Kitson River, 76°02′N, 113°05′W, *S. A. Edlund 42* (CAN). Banks Island, NE part of Parker River Valley, 73°37′N, 115°51′W, *R. Elven 2722/99* (O), *R. Elven 2779/99* (O). Prince Patrick Island, Mould Bay, 76°17′N, 118°49′W, *P. F. Bruggemann 485* (DAO).

In the following key, we also include the morphologically distant *Draba oblongata* as its name has been misapplied for *D. simmonsii* and its relatives.

Key to the Species of the *Draba micropetala* Complex

1a. Fruits densely pubescent with (2 to)5- to 12-rayed trichomes; stigma considerably wider than style; petals white; cauline leaves 2, 1, or absent . . . . . *D. oblongata*

1b. Fruits moderately to sparsely pubescent with a mixture of simple and 2-rayed trichomes; stigma about as wide as style; petals pale yellow or pale reddish yellow; cauline leaves absent.

2a. Petals narrowly obovate, (3.5–)3.8–5.5(–5.8) × (2.5–)2.8–4(–4.6) mm, with non-parallel sides; sepals (2.5–)2.8–3.5(–3.8) mm; fruits lanceolate; subapical abaxial leaf surface with predominantly simple and some dendritic trichomes. . . . . *D. simmonsii*

2b. Petals narrowly spatulate to oblanceolate, 2–3 × 0.7–1.5 mm, with parallel sides; sepals 1.8–2.5 mm; fruits obovate-oblong, elliptic, or elliptic-ovate; subapical abaxial leaf surface with forked, stellate, and some simple trichomes.

3a. Leaves obtuse or rounded, with predominantly cruciform trichomes; infructescence rachis somewhat flexuous, elongating; petals pale yellow; fruits elliptic to elliptic-ovate . . . . . *D. micropetala*

3b. Leaves subacute, with simple or forked trichomes; infructescence rachis straight, not elongating; petals pale reddish yellow; fruits obovate-oblong. . . . . *D. pauciflora*

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Three New Species of *Corydalis* (Fumariaceae) from Northwestern Sichuan, China

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Abstract. The Jiuding Ridge (Sichuan, China) has been explored during the past several years by a team from Chengdu Institute of Biology, Chinese Academy of Sciences, and three undescribed species of *Corydalis* DC. (Fumariaceae) have been revealed and are apparently endemic to this mountain. The new species were observed in forest (*C. capitata* X. F. Gao, Lidén & Y. W. Wang), alpine scree (*C. aeaeae* X. F. Gao, Lidén & Y. W. Wang), and alpine rocky limestone areas (*C. schistostigma* X. F. Gao, Lidén, Y. W. Wang & Y. L. Peng). The two first species have their closest relatives in the Wolong-Balangshan District (Wenchuan, Sichuan). *Corydalis aeaeae* differs from *C. panda* Lidén & Y. W. Wang in its small size, few-flowered racemes, and broadly obtuse outer petals with low, short crests. *Corydalis capitata* differs from the *C. flexuosa* Franchet complex in the capitate racemes, small flowers with deeply serrate petals, and the peculiar, thin, strictly erect lateral branches. *Corydalis schistostigma* is unique in the *C. curviflora* Maximowicz ex Hemsley group, in the deeply cleft stigma and very forward-projecting crests to the inner petals, and possibly has its affinities more to the north and northwest in the Hengduan Mountains.

Key words: China, *Corydalis*, Fumariaceae, IUCN Red List, Sichuan.

Chaping Mountain, with an elevation of 4990 m at Jiuding peak, is located in northwestern Sichuan, China. It is the nearest mountain above 4000 m, close to the Chengdu Plain. There are five natural reserves for protecting pandas and other wild animals in this mountain region. Because the main road runs along the Min River valley on the western side of the mountain and no roads reach the higher elevations, this area was neglected by botanists until 2002. During the past several years, Xin-Fen Gao and Yu-Lan Peng have explored the flora of this beautiful mountain. Among the botanical novelties are three new species of *Corydalis* DC. (Fumariaceae), which are described below. Magnus Lidén and Shengxiang Yu studied the species in the field in 2006, and one example has also been studied in cultivation.

1. Corydalis aeaeae X. F. Gao, Lidén, Y. W. Wang & Y. L. Peng, sp. nov. TYPE: China. Sichuan: Maoxian, Shiguxiang, alpine meadow, 3700 m, flowers pale blue, 20 July 2002, *Xin-Fen Gao, Yu-Lan Peng & Wei-Guo Tu 2517* (holotype, CDBI; isotype, CDBI). Figure 1.

Herba perennis glabra vel raro superne minutissime papillosa; rhizoma tenue breve verticale bulbo apicali tenui ovato; caules ramosi 2- ad 4-foliati ascendentes ad basin debiles; folia radicalia 2- ad 4-ternata foliolis profunde divisis lobis parvis obovatis brevissime mucronatis; folia caulina radicalibus similia sed minora, petiolis brevioribus. Racemi breves, 3- ad 7-flori, in statu frugifero non vel parce elongati; bracteae inferiores (1- ad)2- ad 3-ternatae pedicellos subaequantes lobis acutis, superiores minores parce divisae vel integrae; pedicelli erecti 7–10 mm longi. Sepala 1–2 mm longa; corolla azurea; petalum supernum late

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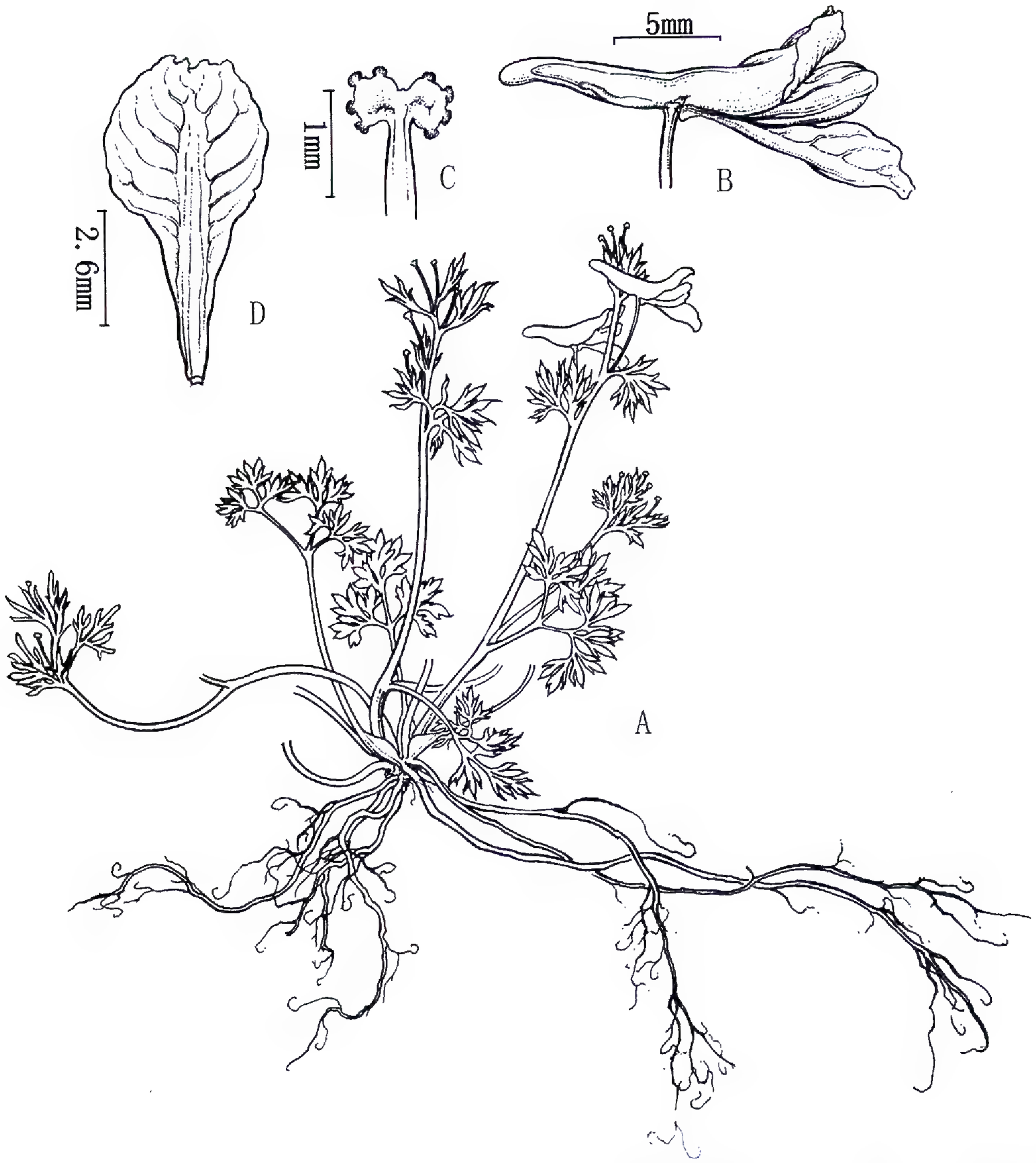

Figure 1. *Corydalis aeaeae* X. F. Gao, Lidén & Y. W. Wang. —A. Habit. —B. Flower. —C. Stigma. —D. Lower petal. Drawn by Jian Gu from the type specimen, *Gao et al. 2517* (CDBI).

obtusum brevissime et angustissime cristatum crista apicem petali non attingenti, calcari leviter curvato; petalum infernum late obtusum basi marsupiatum; stigma divaricatum 8-papillatum. Capsula ex pedicello stricto pendula, anguste fusiformis, venis papillosis.

Herbs, perennial, glabrous; rhizome thin, short, vertical, with fleshy scales and a few remains of broad fleshy leaf bases, crowned by a leaf rosette from a narrowly ovate bulb, and emitting several long, thin, slightly fleshy pale roots, basal portion usually buried below scree or soil surface; stems few to several, thin, ascending, 5–16 cm, simple or often branched with 2 or 3(to 4) leaves, often suffused with brownish purple, especially the stems and undersides and apices of leaf lobes. Petioles of rosette leaves 2–10 cm, lamina 1–4 × 1–3 cm, 2- to 4-ternate with deeply lobed leaflets; the ultimate lobes narrowly obovate, shortly mucronate, 2–4 mm; primary leaflets long-stalked, secondary ones shorter; lamina often densely and finely papillose abaxially, especially along veins. Racemes short, 3- to 7-flowered, not or scarcely elongating in fruit; lower bracts (1)2- to 3-ternate, the upper ones smaller, less divided to entire, with acute lobes; pedicels thin, 7–10 mm, erect in fruit, smooth or finely papillose. Flowers pale to clear azure blue, sepals and veins sometimes with a purplish suffusion, the inner petals pale, but with the dorsal crests apically deeper blue, though usually white at the extreme apex, the purple blotch on the inner side of the inner petals tends to show through, especially in

herbarium specimens; sepals broadly triangular and deeply dentate to lanceolate and almost entire, 1–2 mm; outer petals with broad obtuse limbs, ecristate or usually with a shorter and narrower crest that does not reach the apex; upper petal with a slightly subsigmoidal curved, 9–10 mm spur into which a nectary protrudes ca. halfway or slightly more; inner petals 9–10 mm; the lower petal with a pouch or spurlet at the very base, abruptly widening into a 7-mm-wide, rounded limb; ovary with 12 to 16 ovules; stigma divaricate with 8 papillae. Capsule pendent from erect pedicels, narrowly fusiform, ca. 10 mm with 3 mm style, densely papillose along the veins, ca. 5- to 12-seeded.

Distribution and habitat. *Corydalis aeaeae* occurs usually on scree, sometimes in alpine meadows at 3700–4100 m. It is found only in Sichuan Province, China.

IUCN Red List category. *Corydalis aeaeae* is assessed as a taxon of Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Corydalis aeaeae* flowers in late July to early September, fruits in late August to September.

Etymology. *Corydalis aeaeae* is named after Aeaea, the island described in Greek mythology as the home of the sorceress Circe.

Discussion. The new species is placed in section *Elatae* and is similar to the recently described *Corydalis panda* Lidén & Y. W. Wang (Lidén, 2006), but it is a much smaller and more delicate plant with the leaves more divided, the outer petals comparatively much broader (to 7 mm) and obtuse to shallowly emarginate with shorter and narrower crests, the lower petal with a distinct pouch at the base, the nectary longer, the ovary papillose, and ovules more numerous (12 to 16).

Paratypes. CHINA. **Sichuan:** Maoxian, Fengyi Zhen, Jingzhou Cun, Dagou Zu, Sanjiaojia [31°39.25′N; 103°56.87′E], 3950 m, scree, 5 Aug. 2002, *Xin-Fen Gao, Yu-Lan Peng, Wei-Guo Tu 3257* (CDBI), scree, 4000 m, 30 July 2006, *Lidén & Shengxiang Yu 2006-10* (CDBI, PE, UPS); Shiguxiang, Chashankedu, Shilinsi, 3900 m, scree, 1 Aug. 2006, *Lidén & Shen-Xiang Yu 2006-18* (CDBI, PE, UPS).

2. Corydalis capitata X. F. Gao, Lidén, Y. W. Wang & Y. L. Peng, sp. nov. TYPE: China. Sichuan: Maoxian, Nanxin Zhen, Anxiang, Wucailing, 3000 m, 26 June 2003 [fl. & fr.], *Xin-Fen Gao, Yu-Lan Peng & Hui-Li Zhao 5353* (holotype, CDBI). Figure 2.

Herba perennis glabra; rhizoma breve squamis suberassis imbricatis; caules erecti 4- ad 5-foliati superne ramosi, ramis tenuibus strictis erectis paucifoliatis. Folia radicalia parva obtuso-triangularia biternata foliolis profunde divisis lobis oblongis obtusis; folia caulina radicalibus similia breviter petiolata vel subsessilia. Racemi terminales densissime multiflori in statu fructifero elongati; racemi axillares pauciflori; bracteae petiolatae anguste obovatae lobis parvis paucis lateralibus praeditae praeter; bracteae infimae folia, suprema simulantes; pedicelli erecti tenues 7–12 mm longi, in fructu ad 20–30 mm elongati. Sepala albida ca. 2.5 × 2 mm ovata circumdentata; corolla purpurea; petala exteriora margine dentatum, crista lata acutissime dentata apicem petali conspicue superanti, calcari brevi; petala interiora pallida; stigma rotundatum 8-papillatum. Capsula lineari-oblonga ex pedicello stricto pendula 11- ad 18-sperma; semina parva nitida.

Herbs, perennial, glabrous, self-compatible; rhizome short, with a rather small hibernation bud, and a few coarse long linear roots; stems 1 to several, angular, erect, 35–75 cm, with only 4 or 5 leaves in the upper 1/2 or 2/3. Radical leaves small, like the cauline; cauline leaves shortly stalked (upper ones subsessile), bright green adaxially, glaucous abaxially, rounded-triangular in outline, biternate to subpinnate, with leaflets deeply cleft into oblong obtuse lobes. From the axils of the leaves, strict erect very thin flowering branches are produced, with few and tiny cauline leaves; terminal raceme with 10 to 25 flowers, very dense at anthesis, or perhaps with the basalmost flower more distant, the raceme elongating in fruit; racemes of axillary branches with fewer flowers; bracts narrowly obovate with 1 to 3 pairs of narrow lateral lobes, narrowed into a distinct stalk, 10–20 mm; lower bracts like the upper leaves; pedicels 7–12 mm in flower, elongating to 20–30 mm in fruit, straight and ± erect. Sepals rather large, ovate, margins dentate, ca. 2.5 × 2 mm, white; outer petals purple with broad short blue-purple crests that reach conspicuously beyond the apex of the petal and are sharply dentate, as are the rather wide margins of the limbs; spur comparatively short, ca. 8 mm, oblong, slightly curved, with robust nectary 2/3 as long; inner petals pale, 11–13 mm. Capsules pendent from erecto-patent pedicels, linearly oblong, ca. 11- to 18-seeded, to 20 mm with 2 mm style; seeds smooth, very small, ca. 1 mm.

Distribution and habitat. *Corydalis capitata* has been found only in a very restricted area above the villages Chashankedu and Anxiang from 3000–3300 m, in deep fertile soil in lush forests. It grows in sparse forest with some disturbance by yak, cow, and sheep.

IUCN Red List category. *Corydalis capitata* is assessed as a taxon of Least Concern (LC), according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Corydalis capitata* flowers in June and early July and with the occasional late raceme into

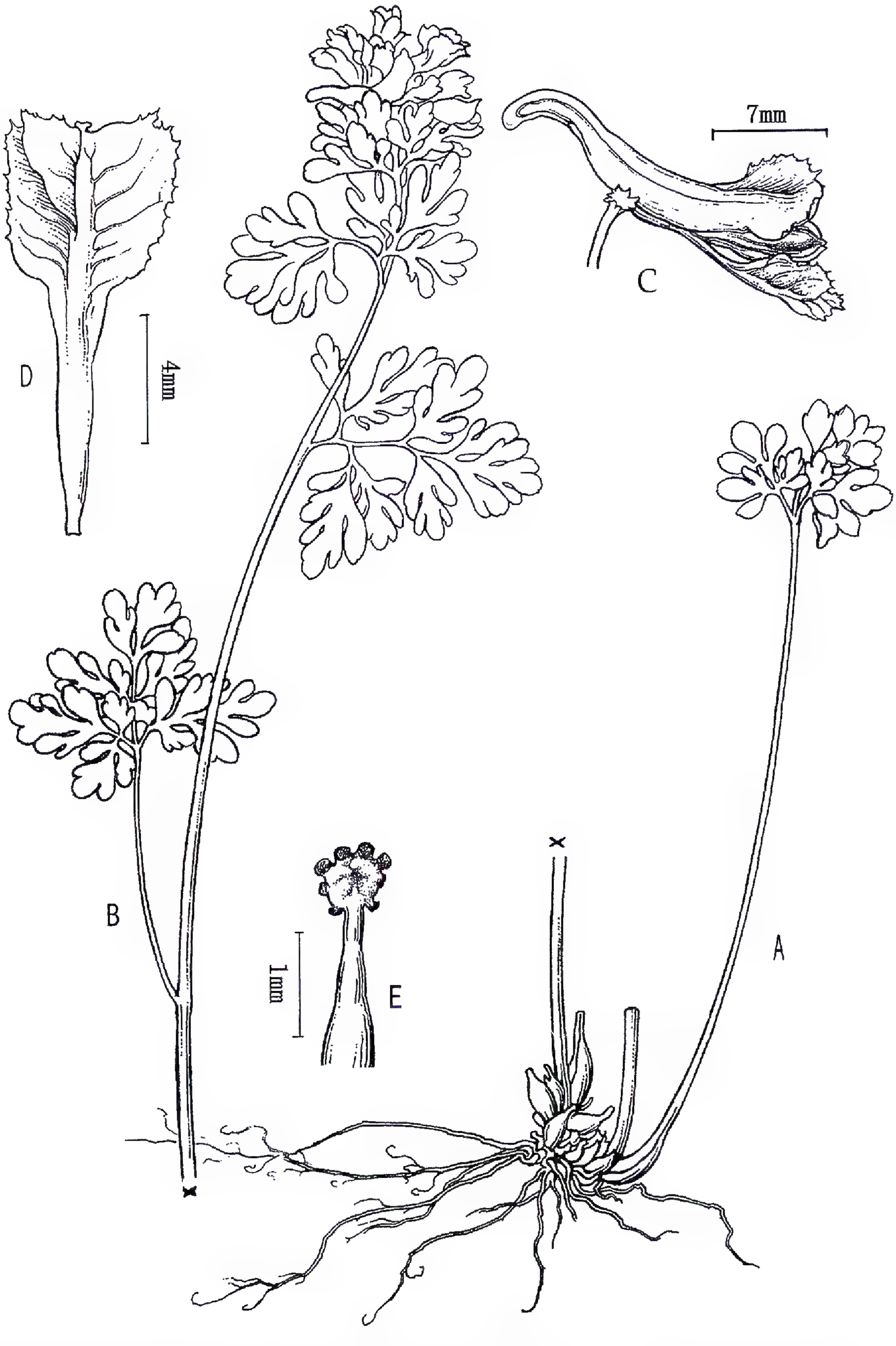

Figure 2. *Corydalis capitata* X. F. Gao, Lidén & Y. W. Wang. —A, B. Habit. —C. Flower. —D. Lower petal. —E. Stigma. Drawn by Jian Gu from the type specimen, *Gao et al. 5353* (CDBI).

early August. It is unmistakable with its densely packed flower heads. In late autumn, when the stems wither, several fresh basal leaf rosettes are formed.

Etymology. The specific epithet refers to the head-like inflorescence (from the Latin "caput," meaning "head").

Discussion. *Corydalis capitata* has been sold through the Internet by the Chen Yi nursery in Beijing, and is presently in cultivation in Europe. The origin of these cultivars is unknown.

Corydalis capitata is placed in section *Elatae*; it is slightly similar to *C. calycosa* H. Chuang, but is easily distinguished by the very dense racemes, the smaller

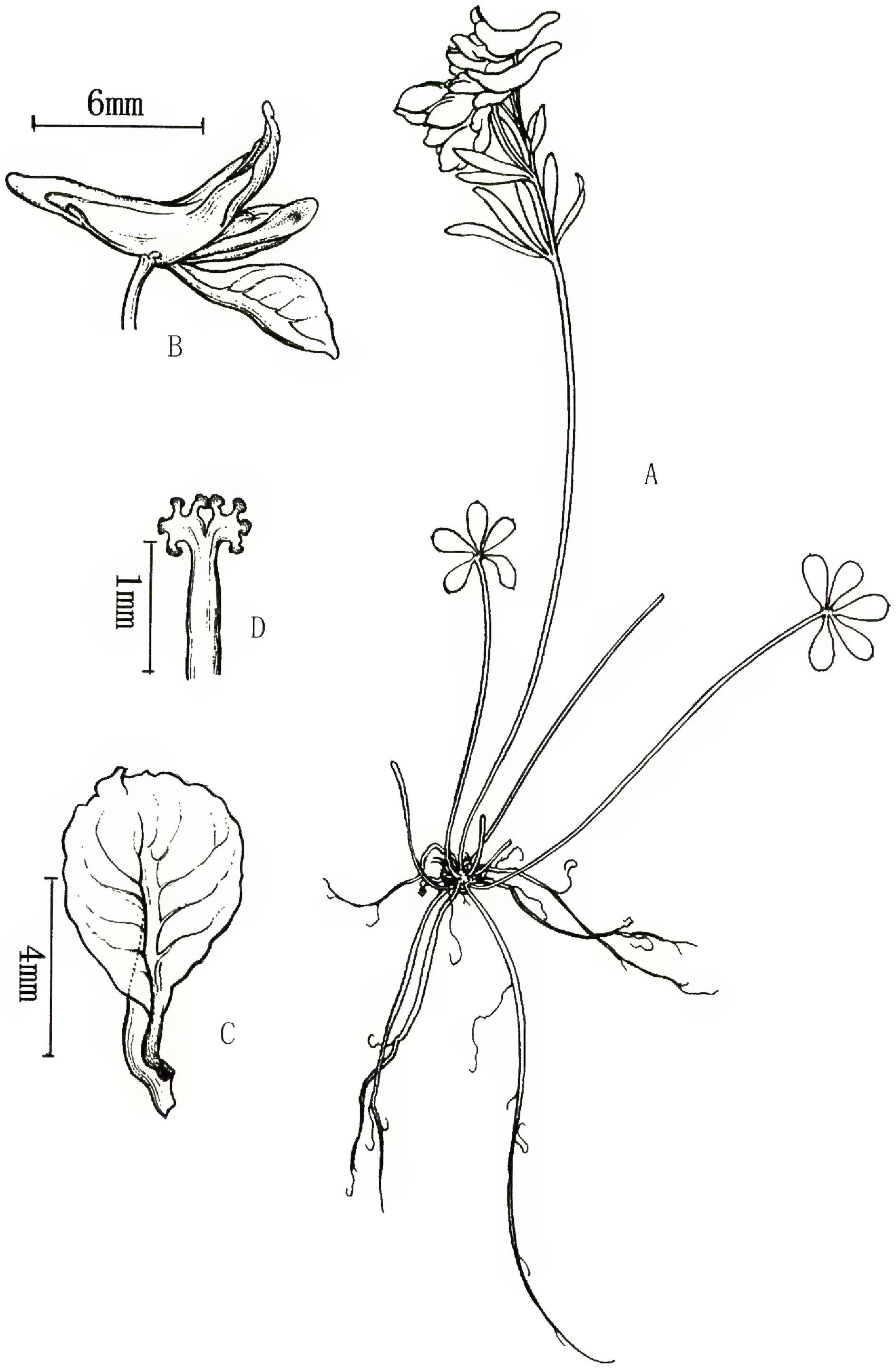

Figure 3. *Corydalis schistostigma* X. F. Gao, Lidén, Y. W. Wang & Y. L. Peng. —A. Habit. —B. Flower. —C. Lower petal. —D. Stigma. Drawn by Jian Gu from the type specimen, *Gao et al. 2483* (CDBI).

purple flowers with sharply serrate crests and margins, the large sepals, and the peculiar thin erect lateral branches.

Paratypes. CHINA. **Sichuan:** Maoxian, Shiguxiang, Chashankedu, Doukoulinguan, 3180 m, 19 July 2002 [fr.], *Xin-Fen Gao, Yu-Lan Peng & Wei-Guo Tu 2409* (CDBI), 3320 m, 19 July 2002 [fl.], *Xin-Fen Gao, Yu-Lan Peng & Wei-Guo Tu 2425* (CDBI), 1 Aug. 2006, *Lidén & Shen-Xiang Yu 17* (PE, UPS). Unknown origin, cultivated from commercial source (UPS).

3. Corydalis schistostigma X. F. Gao, Lidén, Y. W. Wang & Y. L. Peng, sp. nov. TYPE: China. Sichuan: Maoxian, Shiguxiang, Chashankedu, Shilinsi, in sparse bushes, corolla bluish purple, 3575 m, 19 July 2002, *Xin-Fen Gao, Yu-Lan Peng & Wei-Guo Tu 2483* (CDBI). Figure 3.

Herba perennis glabra; rhizoma tenuissimum lineare, bulbo apicali tenuissimo ovato, radicibus penariis linearibus; caulis saepe solitarius tenuis erectus simplex uni- vel bifoliatus basi filiformis. Folia radicalia rotundata ternata vel quinata foliolis late obovatis, petiolis filiformibus; folia caulina sessilia in lobos 3 ad 5 anguste lanceolatos vel oblongos usque ad basin secta. Racemi breves, 3- ad 9-flori; bracteae integrae lanceolatae (bractea infima saepe profunde trifida) pedicellos erectos strictos tenues 10–15(–20) mm longos subaequantes vel eis breviores. Sepala minutissima; corolla caerulea vel cyanea, saepe partim purpureo-suffusa; petalum supernum latum subobtusum vix cristatum sursum curvatum, calcari substricto conico; cristae petalorum interiorum bene evolutae apices petalorum valde superantes; stigma profunde bifidum in quoque segmento 4-papillatum. Capsula ignota sed verisimiliter ex pedicello stricto pendula.

Herbs, perennial, glabrous; rhizome thin, terminating in a shortly stalked tiny bulb with a leaf rosette, and with scattered thin slightly fleshy pale linear storage roots; stems few, thin, erect, 8–20 cm tall, simple, with 1 or 2 leaves in the upper 1/3. Radical leaves with petioles 1–10 cm, lamina rounded, 10–15 mm wide with 3 to 5 obovate leaflets, dark green adaxially, glaucous abaxially, glabrous; cauline leaves sessile, cut to the base into 3 to 5 narrowly lanceolate lobes, 10–15(–20) mm. Racemes 3- to 9-flowered; bracts lanceolate, entire or the lowermost often divided; pedicels straight, thin, erect, 10–15(–20) mm. Sepals very small, 0.2–0.4 mm; corolla deep blue, with pinkish purple markings on keels of outer petals, sometimes with a pinkish suffusion toward the spur, sepals, and apex of inner petals (crest excepted), rarely pale blue; upper petal narrowly cristate, acute and curved upward at apex, with an 8–9 mm conical spur with nectary reaching more than halfway; lower petal with very short claw, gradually broadened into a broad rounded acuminate limb to 7 mm wide; inner petals 9 mm with very pronounced dorsal crests that protrude conspicuously beyond the junction of the inner petals; ovary with 14 to 16 ovules; stigma very deeply cleft, each half with 4 papillae, of which the basal ones show a tendency to be geminate. Fruit not known.

Distribution and habitat. *Corydalis schistostigma* can sometimes be found in grassland, but prefers more rocky habitats, usually on limestone, from 3500–3900 m. It is found only in Sichuan, China.

IUCN Red List category. *Corydalis schistostigma* is assessed as a taxon of Least Concern (LC), according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Corydalis schistostigma* flowers in late July to August.

Etymology. The specific epithet refers to the deeply cleft stigma (from the Greek "schizein," meaning "to cleave").

Discussion. *Corydalis schistostigma* is placed in section *Fasciculatae* series *Curviflorae*. The most similar species to *C. schistostigma* is *C. shensiana* Lidén ex C. Y. Wu, H. Chuang & Z. Y. Su, which has more numerous and more divided leaves, 7- to 15-flowered racemes, more or less dentate outer petals, a short and obtuse spur, shorter nectary, white-tipped inner petals (concolorous in *C. schistostigma*), and stigma with prominent basal lobes. *Corydalis cytisiflora* (Fedde) Lidén s.l., which is abundant in grasslands at the type locality, differs substantially from the new species in the broadly crested outer petals, numerous flowers, and stigma cleft up to half with rounded basal lobes (vs. stigma very deeply cleft without obvious basal lobes).

Paratypes. CHINA. **Sichuan:** Maoxian, Tumen Zhen, Guangming, Guolupengzi [31°39.289′N, 103°57.232′E], 3800–4000 m, meadow, 5 Aug. 2002, *Xin-Fen Gao, Yu-Lan Peng & Wei-Guo Tu 3147* (CDBI); Maoxian, Fengyi Zhen, Jingzhou Cun, Dagou Zu, Sanjiaojia [31°39.25′N, 103°56.87′E], 3800–3900 m, limestone, 30 July 2006, *M. Lidén 06-07, 13* (PE, UPS); Shiguxiang, Chashankedu, Shilinsi, 3500–3800 m, 1 Aug. 2006, *M. Lidén 06-20* (PE, UPS).

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Taxonomic Identity of *Musa nagensium* (Musaceae) in Southeast Asia

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Abstract. Since the early 20th century, the taxonomic identity of *Musa nagensium* Prain (Musaceae) has been uncertain to most botanists. The aim of this paper is to clarify the taxonomic history of *M. nagensium*. A new variety, *M. nagensium* var. *hongii* Häkkinen, is described and illustrated here. This rare variety of *M. nagensium* was found only in a small area in northwestern Yunnan, China, near the Burmese border. This study is based on observed morphological characteristics in the field and from specimens in various herbaria, and is supported by the existing literature on the Musaceae. A key to *M. nagensium* and related taxa is provided.

Key words: China, IUCN Red List, *Musa*, Musaceae, wild banana, Yunnan.

Musa nagensium Prain (Musaceae) was initially described by David Prain in the Royal Botanic Garden, Calcutta (today the Indian Botanic Garden, Howran), based on the plant grown from rootstock collected from the Naga Hills region in the states of Nagaland and Assam, India (Prain, 1904). *Musa nagensium* is also mentioned in other literature, but without detailed descriptions (Fawcett, 1913; Fisher, 1931; Wilson, 1946; Cheesman, 1948; Simmonds, 1956a, b, 1960; Champion, 1967; Simmonds & Weatherup, 1990; Hore et al., 1992; Liu et al., 2002; Uma et al., 2005). However, its true status fell into oblivion and it is today unknown to most botanists. It is commonly confused with *M. cheesmanii* Simmonds (Simmonds, 1956a), which grows in upper Assam (Uma et al., 2005). *Musa nagensium* has been reported to grow in the Naga Hills region, its original habitat, sympatric with *M. balbisiana* Colla (Colla, 1820; Häkkinen, pers. obs.). In contrast, the new variety *M. nagensium* var. *hongii* Häkkinen is sympatric with *M. acuminata* Colla var. *chinensis* Häkkinen & H. Wang, *M. balbisiana*, *M. itinerans* Cheesman var. *chinensis* Häkkinen, and *M. yunnanensis* Häkkinen & H. Wang in Tongbiguan Nature Reserve, west Yunnan, China, and in the adjacent Xima area (Häkkinen & Wang, 2007; Häkkinen et al., 2008). No hybridization between the species in sympatric growth was observed (Häkkinen, 2006, pers. obs.). G. B. Wilson noted in his cytological studies in Jamaica that there are two different varieties of *M. nagensium*, but he did not further specify them, only mentioning that the plants originated in botanical collections (Wilson, 1946).

Extensive field observations were made by the author during an expedition in 2006 to Yunnan Province, Yingjiang District, China. The new variety is described based on living plants in the field by completing the International Network for the Improvement of Banana and Plantain (INIBAP) *Musa* descriptor list (IPGRI-INIBAP/CIRAD, 1996). The descriptive terms here follow the traditional banana taxonomy as used by Simmonds (1962, 1966). Relevant portions of the specimens were deposited as holotype at the herbarium of the Xishuangbanna Tropical Botanical Garden (HITBC), and isotypes were deposited at the herbaria of H, IBSC, and MO.

1. Musa nagensium Prain, J. Asiat. Soc. Bengal 73: 21. 1904. TYPE: [India.] Assam: Nagaland, Joboca, Calcutta, Royal Bot. Garden, 3 Sep. [19]03, *Abdul Huq s.n.* (lectotype, designated by Liu et al., 2002, K; isotypes, BM, E).

1a. Musa nagensium var. **nagensium**. Figure 1A.

Distribution and habitat. Variety *nagensium* is native to the Naga Hills region in the states of Nagaland and Assam, India. It is assumed to now be rather rare because its occurrence has not been reported since 1992 (Hore et al., 1992; Häkkinen, pers. obs.).

IUCN Red List category. Only a few plants of variety *nagensium* were seen in the Naga Hills region in the states of Nagaland and Assam, India. This taxon is of conservation concern and should be considered at least Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001). Further study is needed in Nagaland, India, and in adjacent Burma.

Discussion. *Musa cheesmanii* has been commonly misidentified as *M. nagensium* var. *nagensium* (Uma

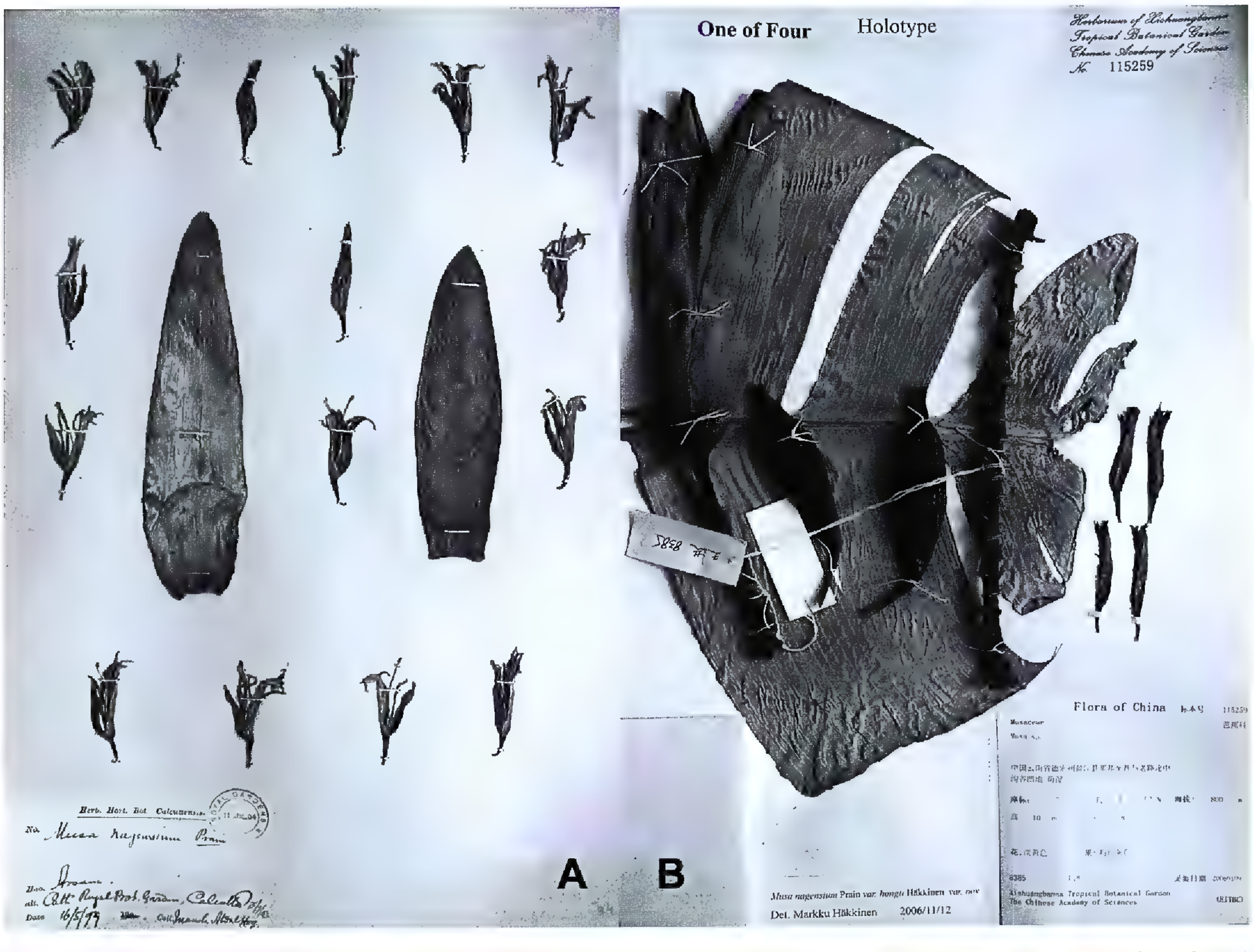

Figure 1. *Musa nagensium* Prain. —A. Lectotype of *M. nagensium* var. *nagensium* (*Abdul Huq s.n.*, K). Photo by M. Häkkinen. —B. Holotype of *M. nagensium* var. *hongii* Häkkinen (*Wang Hong 8385*, HITBC). Photo by Wang Hong.

et al., 2005; Häkkinen, pers. obs.). This is because the pure form of variety *nagensium* is no longer found in its natural habitat. *Musa cheesmanii* can be easily distinguished from *M. nagensium* by its upward-pointing fruits versus the downward-pointing fruits of *M. nagensium* (Fig. 2). High genetic variation of *M. nagensium* in those known locations is due to environmental stress caused by its mountainous habitat. In order for this species to survive in the various environments, it underwent substantial genetic changes and evolved into different varieties. This is quite a common phenomenon in wild bananas (Häkkinen, 2003, 2004, 2006; Häkkinen & Meekiong, 2004, 2005; Häkkinen et al., 2005, 2007). The chromosome number ($2n = 22$) for *M. nagensium* was determined by Wilson (1946).

Additional specimens examined. BURMA. **Myitkyina Distr.:** Tagwin Chaung, in evergreen forest, 24 Nov. 1928, *C. E. Parkisson 1759* (K). INDIA. **Assam:** Nagaland, Royal Bot. Garden Calcutta, 3 Sep. [19]03, *Abdul Huq* (BM, E), Nagaland, 1960, *NRFP 60* (E).

1b. Musa nagensium var. **hongii** Häkkinen, var. nov. TYPE: China. Yunnan: Dehong Distr., Yingjiang Co., Xima, old way from Xima to Tongbiguan, seasonal rainforest, wet valley, 800 m, 9 Jan. 2006, *Wang Hong 8385* (holotype, HITBC [4 sheets]; isotypes, H, IBSC, MO). Figure 1B.

Varietas nova a varietate typica facie bracteae floralis exteriore laete flava vel aurantiaca, marginibus rubrescentibus (non lateritio-miniata), bractearum apicibus obtusis imbricatisque (non apicibus acutis convolutisque) et fructu minore, ca. 9 × 3.5 cm (non 12–15 × 3 cm) distinguitur.

Plant tall, suckering close to parent plant 20–50 cm, to 5 suckers, vertically arranged; mature pseudostem to 11 m, to 25 cm diam. at base, of variable appearance with dead brown waxy sheaths, underlying color ivory with large pink-purple blotches, shiny; sap milky. Petiole to 50 cm, canal margins overlapping, bases winged and clasping the pseudostem with corrugated margins; leaves erect, lamina to 200 × 65 cm, narrowly elliptic, truncate at the apex, adaxially dark green, dull, abaxially silvery, very waxy; leaf bases asymmetric, both sides rounded and auriculate, midrib light green on both sides, with slightly corrugated lamina. Inflorescence arching vertically downward; peduncle to 70 cm, ca. 3 cm in diam., glabrous, light green, waxy; 2 sterile bracts present, persistent at the opening of the first female

Figure 2. Fruit bunch of *Musa nagensium* Prain var. *hongii* Häkkinen. Photo by M. Häkkinen at Tongbiguan Nature Reserve, Yunnan, China.

flowers. Female bud lanceolate, to 43 × 8 cm, bracts externally bright yellow to orange with reddish margins and very waxy, bright yellow without wax internally, imbricate, obtuse and lifting one bract at a time, not revolute before falling; basal flowers female, ca. 15 cm; ovary light green, with ovules arranged in 2 rows per locule; compound tepal ca. 4.5 cm with 2 prominently thickened keels, orange; free tepal ca. 4.5 cm, oval with thickened keel, translucent white with orange apex; stamens 5, ca. 3.5 cm, lacking pollen, light green; stigma brown, ca. 0.8 cm diam.; male bud lanceolate, ca. 25 × 5.5 cm, bracts externally bright yellow to orange with reddish margins and very waxy, bright yellow without wax internally, imbricate, lifting one bract at a time, not revolute before falling; male flowers on average 12 per bract in 2 rows, falling with the bracts; compound tepal ca. 4.6 cm with 2 thickened keels, orange; free tepal ca. 3 cm, oval with thickened keel, translucent white with orange apex; stamens 5, ca. 1 cm, filaments light green; anthers orange to brown, inserted; stigma light green, ovary arched, light green, without additional pigmentation. Fruit bunch compact, with 7 hands and 14 fruits per hand on average, in 2 rows, fingers hanging downward toward the long pendulous rachis; individual fruit ca. 9 × 3.5 cm, slightly curved, pronouncedly ridged, pedicel 3.5 cm, glabrous, fruit apex long-pointed with some floral relicts, immature fruit peel silvery, very waxy, remaining silvery at maturity with some black-purple blotches, immature fruit pulp white, remaining white and soft at maturity; seeds irregularly rounded, ca. 11 × 7 mm, with seed coat warty brownish black except for the white circum-hilar area, 60 to 80 seeds per fruit.

Distribution and habitat. *Musa nagensium* var. *hongii* is very common in Yingjiang County, Dehong, Yunnan, in the area bordering Burma, occurring typically at elevations from 800–1300 m in moist ravines (Häkkinen, pers. obs.). It is reported (Cheesman, 1948) occurring in Myitkyina District, Burma, but these areas need further study.

IUCN Red List category. One variety of *Musa nagensium* has been studied by the author in China in 2006. Variety *hongii* has 25 known wild populations in the border area west of Yunnan and continuing toward Burma (Häkkinen, pers. obs.). As a result, the author designates its conservation status as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The new variety of *Musa nagensium* is named in honor of curator Wang Hong from the Xishuangbanna Tropical Botanical Garden Herbarium for his contributions to the botany of China.

Discussion. Variety *hongii* can be distinguished from the typical variety of *Musa nagensium* by the external flower bract coloration (bright yellow to orange with reddish margins vs. brick red to flame scarlet); the obtuse and imbricate bract apices (vs. acute and convolute); and shorter fruits (ca. 9 × 3.5 cm vs. 12–15 × ca. 3 cm).

Paratypes. CHINA. **Yunnan:** Dehong Distr., Yingjiang Co., Xima, Mu Lai River, mtn. slope, 930 m, 8 Jan. 2006, *Wang Hong 8383* (HITBC); Tongbiguan Nature Reserve, 1050 m, Apr. 1996, *A. Kimura & T. Goto s.n.* [seeds donated to Kew by Atagawa Tropical Garden, 20 Feb. 1998; voucher on 24 Oct. 2000, cult. plants at Kew identified by Häkkinen Apr. 2002] (K [2]).

Key to the Species of *Musa* and Varieties of *M. nagensium* in China, India, and Burma

1a. Flower bracts externally flame scarlet; bract apices acute and convolute. . . . *M. nagensium* var. *nagensium*
1b. Flower bracts externally bright yellow to orange with reddish margins; bract apices obtuse and imbricate 2
2a. Mature fruits pointing downward toward male bud . . . . . *M. nagensium* var. *hongii*
2b. Mature fruits pointing upward toward peduncle 3
3a. Pseudostem with underlying color brownish red; sap milky; lamina hardly waxy, grayish; seeds flattened, ca. 8 × 5 mm. . . . . *M. cheesmanii*

3b. Pseudostem with underlying color yellowish green; sap watery; lamina without wax, glaucous; seeds globose, ca. 5 × 4 mm 4
4a. Male bud broadly ovoid with obtuse apex, bracts imbricate, internally dark crimson, lifting several bracts at the same time, not revolute . . . *M. balbisiana*
4b. Male bud lanceolate with pointed yellowish apex, no imbrication, internally cream, lifting several bracts at a time, revolute 5
5a. Petiole margins curved inward; leaf bases auriculate; peduncle pubescent with short hairs; arrangements of ovules in 4 rows per locule . . *M. yunnanensis*
5b. Petiole margins erect; leaf bases rounded; peduncle glabrous; arrangements of ovules in 2 rows per locule . . . . . *M. acuminata* var. *chinensis*

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A New Species of *Linaria* Sect. *Versicolores* (Scrophulariaceae) from Iran

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Abstract. *Linaria iranica* Hamdi & Assadi (Scrophulariaceae) is a new species from Kerman Province, Iran. It belongs to *Linaria* Miller sect. *Versicolores* (Bentham) Wettstein, and its closest relative is *L. tenuis* Sprengel. *Linaria iranica* differs from *L. tenuis* in the smaller corollas (7–8 mm vs. 12–17 mm), longer spurs relative to the remaining corolla, smaller capsules (3–3.2 mm vs. 3.5–6 mm), and the ornamentation of seed surfaces.

Key words: Iran, IUCN Red List, *Linaria*, Scrophulariaceae.

Linaria Miller is widely distributed throughout the world and is introduced in the Americas (Hong, 1983). The genus comprises annual or perennial herbs that grow in diverse habitats including dry and sandy areas and rocky slopes. Sutton (1988) recognized 150 species, of which 24 occur in Iran. This genus is divided into seven sections mainly based on seed morphology. The seeds in section *Versicolores* (Bentham) Wettstein are reniform, irregularly trigonous, or tetrahedral, and not laterally compressed. It is composed of 21 species worldwide, of which one occurs in Iran. Geographically, section *Versicolores* is distributed in Central and Southern Europe, West and South Asia, and North Africa. Sutton (1988) recognized some 150 species, of which 25 occur in Iran (Boiss, 1867; Parsa, 1949; Davis, 1982; Sutton, 1988; Hamdi et al., 2005a, b, 2006, 2007). While revising *Linaria* material among herbaria in Iran (IRAN, TARI, TUH, FUMH), specimens were found that could not be identified as any known species of *Linaria*. Closer investigation, including micromorphological studies of the seed and capsule surfaces, revealed that the material represents a hitherto undescribed species of *Linaria* sect. *Versicolores*.

Linaria iranica Hamdi & Assadi, sp. nov. TYPE: Iran. Kerman Province: Girouft, 1300–1600 m, 10 May 1998, *M. Mirtadzadini s.n.* (holotype, TARI 95669). Figures 1, 2.

Planta annua, herbacea, glauca, inflorescentia excepta glabra, erecta; caules fertiles 15–20 cm longi, supra ramosi. Folia caulina fertilia 10–20 × 0.3–0.4 mm, alterna, filiformia, acuta. Inflorescentia 2–5 cm longa, floribus 2 ad 5, laxa; bracteae ca. 2 × 0.5 mm, apice acutae, glandulosae, lanceolatae; pediceli 2.5–3 mm longi, glanduloso-villosi. Calycis lobi inequales, 2.5–3 × 0.6–0.8 mm, apice subacuta, lineari-lanceolati; corolla 7–8 mm longa, flava; tubus ad os ca. 2.5 mm latus; sinus labii 0.7–0.75 mm longi; calcar ca. 4 mm longum, ad basem ca. 0.8 mm latum, rectum. Capsula 3–3.2 × 2.4–2.6 mm. Semina 0.6–0.65 × 0.32–0.36 mm, 3- vel 4-angulata.

Annual herb, glaucous, glabrous except for inflorescences, erect; fertile stems 15–20 cm, branched above. Leaves of fertile stems 10–20 × 0.3–0.4 mm, alternate, filiform, acute. Inflorescences 2–5 cm, 2- to 5-flowered; inflorescence axes lax in flowering and fruiting, fertile bracts ca. 2 × 0.5 mm, apices acute, lanceolate, glandular-villose; pedicels 2.5–3 mm, glandular-villose. Calyx lobes unequal, 2.5–3 × 0.6–0.8 mm, apices subacute, lanceolate to linear, not scarious, glandular-villose; corollas 7–8 mm, yellow, corolla tubes ca. 2.5 mm wide at mouth, adaxial lip with sinuses 0.7–0.75 mm, distance between lip apices ca. 1.5 mm, corolla spurs ca. 4 mm long, ca. 0.8 mm wide at base, straight, length equaling half of corolla. Capsules 3–3.2 × 2.4–

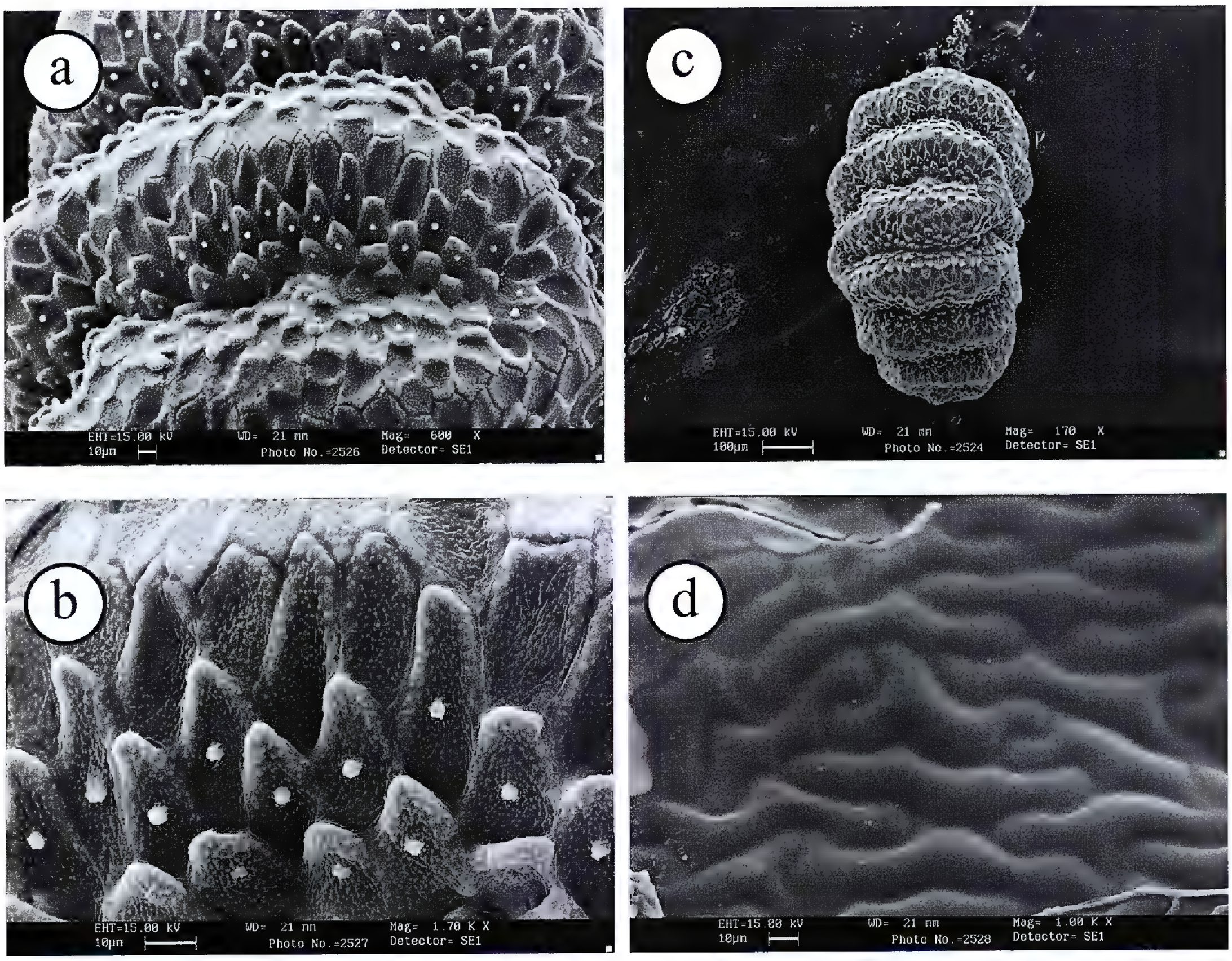

Figure 1. SEM images of seeds and capsule of *Linaria iranica* Hamdi & Assadi. —A. Transverse seed ridges showing periclinal wall of testa cells from sides of ridges with long median papillae and slight marginal papillae. —B. Transverse ridges showing periclinal wall of testa cells from sides of ridges with long median papillae and slight marginal papillae. —C. Lateral view of seed, showing transverse ridges with few anastomoses. —D. Surface of inside capsule wall at the base of valve from dehisced capsule. A–D from the type *Mirtadzadini s.n.* (TARI 95669).

2.6 mm; seeds 0.6–0.65 × 0.32–0.36 mm, 3- to 4-angled, dark gray; seed with 5 to 7 transverse ridges; seed testa cell ca. 50 × 12 µm.

Distribution, habitat, and IUCN Red List category. *Linaria iranica* grows in mountainous habitats of Kerman Province, in southern Iran, at elevations from 1300–1800 m and is presumably endemic. It seems to be limited to the upper alpine climatic zone (Kerman subprovince, Iran-Turanian region) (Zohary, 1963, 1973). From a phytosociological point of view, it is part of the grassland communities in Iran. The conservation status of the new species is considered to be incomplete according to IUCN Red List criteria (IUCN, 2001), with an assessment of Data Deficient (DD).

Etymology. The species epithet recognizes the country of origin, Iran.

Relationships. *Linaria iranica* is allopatric to, and appears to be related to, *L. tenuis* Sprengel, with the latter species from north-central and Northeast Africa and Southwest Asia (Palestine, Iraq, Libya, Syria, Saudi Arabia) (Sutton, 1988). The new species differs from *L. tenuis* in the size of the corollas, capsules, spurs, bracts, and seeds, as well as in the ornamentation of seeds (Table 1). Seed coat micromorphology (Elisens, 1985) provides further differences within the Scrophulariaceae, and less conspicuous differences may be seen in the shape and size of the seed coat cells (Fig. 1, Table 1).

KEY FOR DISTINGUISHING *LINARIA TENUIS* AND *L. IRANICA*

1a. Corollas 12–17 mm, spurs 1/3 length of remaining corolla. . . . . *L. tenuis*
1b. Corollas 7–8 mm, spurs 1/2 length of remaining corolla. . . . . *L. iranica*

Acknowledgments. We thank N. Sadeghi and S. Eshghi for assistance with the scanning electron microscope from Islamic Azad University Science and Research Branch for scanning the seed coat. We also thank M. Mehranfard from IRAN herbarium for the drawing of the new species.

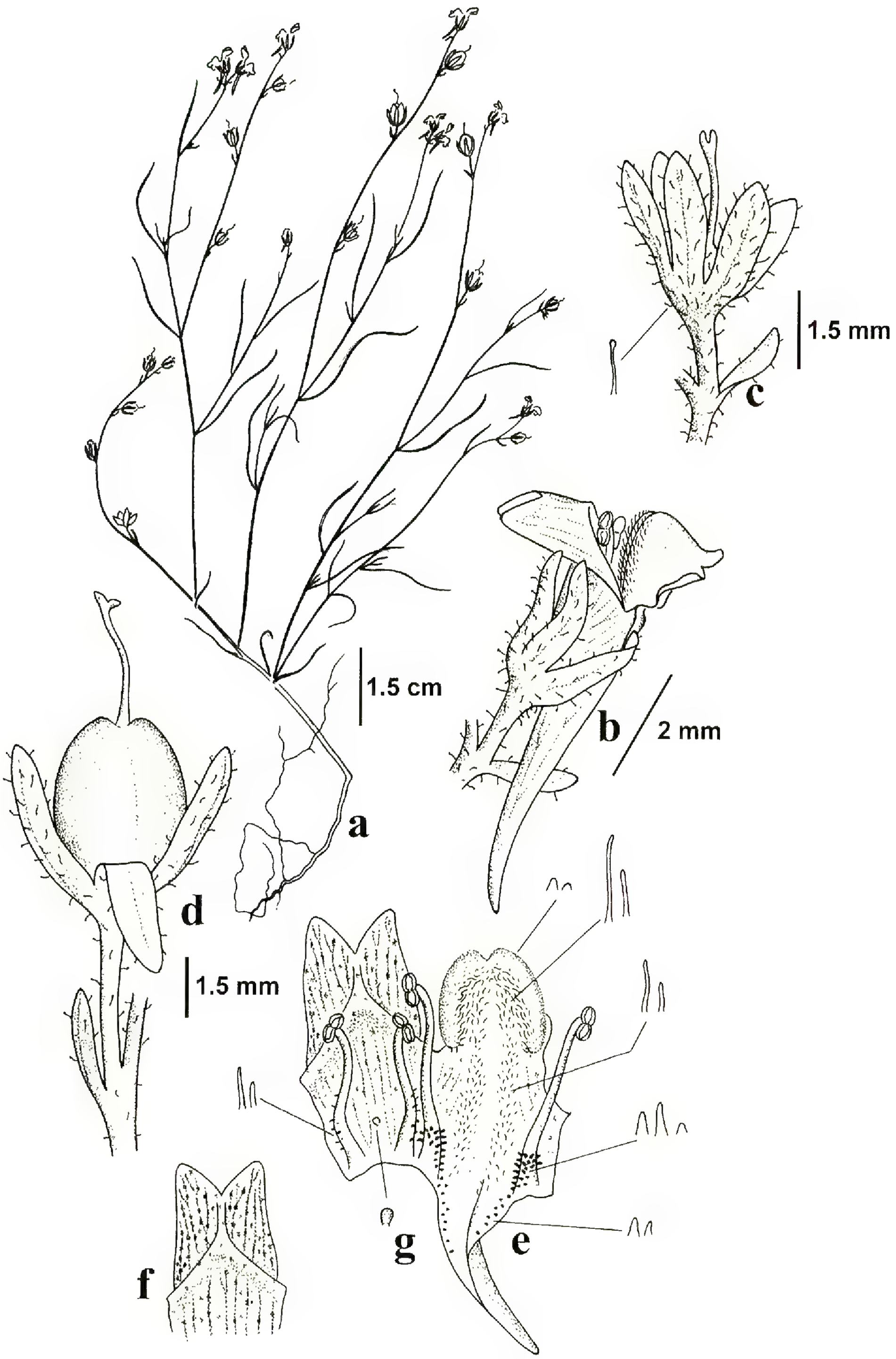

Figure 2. *Linaria iranica* Hamdi & Assadi. —A. Habit. —B. Flower. —C. Flower with corolla removed. —D. Capsule. —E. Floral dissection, with stamens evident. —F. Flower, adaxial lip of corolla with sinus. —G. Floral dissection, sterile stamen. A–G drawn from the holotype *Mirtadzadini s.n.* (TARI 95669) by M. Mehranfard.

Table 1. Morphological comparison of *Linaria iranica* and *L. tenuis*.

Characters	*L. iranica*	*L. tenuis*
Stem (cm)	15–20	6–58
Leaves (mm)	10–20 × 0.3–0.4	8–60 × 0.5–1.8
Pedicel (mm)	2.5–3	1.5–3.5
Fertile bracts (mm)	ca. 2 × 0.5	2–10 × ca. 0.7
Calyx lobes (mm)	2.5–3 × 0.6–0.8	2.5–6 × 0.5–1.7
Corollas (mm)	7–8	12–17
Adaxial lip with sinuses (mm)	0.7–0.75	0.6–1
Spurs (mm)	ca. 4 × 0.8 at base	3.5–6 × ca. 1
Spur:corolla ratio	1:2	1:3
Capsules (mm)	3–3.2	3.5–6
Seeds (mm)	0.6–0.65 × 032–036	0.7–0.8
Seed transverse ridges	5–7	5–9
Seed testa cell (μm)	ca. 50 × 12	30–45 × 15–20

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Plagiothecium shevockii (Plagiotheciaceae), a New Species from Taiwan

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Abstract. *Plagiothecium shevockii* S. He (Plagiotheciaceae) is described and illustrated as a new moss species from Taiwan. It resembles *P. paleaceum* (Mitten) A. Jaeger in having similar orbicular leaves, but differs by its much stronger double costae, and its slenderly acute and denticulate leaf apices that have a group of differentiated, hyaline, thin-walled cells often bearing rhizoids.

Key words: China, IUCN Red List, Plagiotheciaceae, *Plagiothecium*, Taiwan.

Plagiothecium Bruch & Schimper has been considered the only genus in the family Plagiotheciaceae (Buck & Ireland, 1985; Buck & Goffinet, 2000; Crosby et al., 2000), but it is often associated with *Herzogiella* Brotherus, *Isopterygium* Mitten, and *Taxiphyllum* M. Fleischer of the Hypnaceae (Ireland, 1969; Iwatsuki, 1970). Pedersen and Hedenäs (2001, 2002), however, consider the Plagiotheciaceae to contain 11 genera—*Bardunovia* Ignatov & Ochyra, *Catagonium* Müller (Halle) ex Brotherus, *Herzogiella* Brotherus, *Isopterygiopsis* Z. Iwatsuki, *Myurella* Bruch & Schimper, *Orthothecium* Schimper, *Plagiothecium*, *Platydictya* Berkeley, *Pseudotaxiphyllum* Z. Iwatsuki, *Rhizofabronia* (Brotherus) M. Fleischer, and *Struckia* Müller (Halle)—on a much broader sense. At present, the genus comprises some 50 accepted names in the world (Crosby et al., 2000); nearly half of them are well-understood, temperate species.

Plagiothecium is characterized by its complanate habit, leaves with well-developed, decurrent alar regions, and stems with an outer row of large, thin-walled cells in cross section (Buck & Ireland, 1985). It has a hypnoid peristome, but this is not especially useful in distinguishing species of *Plagiothecium* from its closely related genera. Furthermore, the capsule orientation and peristome development vary within the genus. Recognizing *Plagiothecium* depends on its gametophytic features, especially its strong leaf decurrencies, often asymmetric leaves, and double or forked costae. Characters separating *Plagiothecium* species are subtle, and the observer must rely primarily on differences in leaf foliation, shapes, symmetry, characteristics of decurrency, degree of marginal serration and leaf cell sizes. In *Plagiothecium*, vegetative propagation by cylindrical or fusiform brood bodies of two to seven cells, either on the dorsal surface of the leaf apices or in the leaf axils on stems and branches, occurs in many species, i.e., *P. cavifolium* (Bridel) Z. Iwatsuki, *P. curvifolium* Schliephacke ex Limpricht, *P. denticulatum* (Hedwig) Schimper, *P. laetum* Schimper, *P. latebricola* Schimper, *P. neckeroideum* Schimper, *P. nemorale* (Mitten) A. Jaeger, and *P. succulentum* (Wilson) Lindberg (Ireland, 1969; Iwatsuki, 1970; Lewinsky, 1974). Leaf apical rhizoids have been reported for some species, such as *P. drepanophyllum* Renauld & Cardot (Sharp et al., 1994), *P. neckeroideum* (Iwatsuki, 1970), *P. nemorale* (Hedenäs, 1992), and *P. platyphyllum* Mönkemeyer (Lewinsky, 1974). Although in *Plagiothecium* many species have broadly ovate leaves, plants having orbicular leaves are rare. Only one species, *P. paleaceum* (Mitten) A. Jaeger, has been described with orbicular leaves (Enroth et al., 1992). A peculiar *Plagiothecium*-like moss was recently collected from Taiwan by James Shevock. It is quite distinct in having orbicular leaves with strongly decurrent leaf bases, slenderly acute, dentate leaf apices, and a group of short, hyaline, thin-walled cells at the leaf apices that have rhizoids on their abaxial surface. No other moss with these features is known in the genus *Plagiothecium*; it is here described as a new species.

Plagiothecium shevockii S. He, sp. nov. TYPE: China. Taiwan: Miaoli Co., Shei-Pa Natl. Park, 24°23′30″N, 121°13′45″E, on metamorphic rock underhang, 3600 m, 26 Apr. 1999, *J. Shevock 18109* (holotype, MO; isotypes, CAS, PE, TAIE, UC). Figure 1.

Plagiothecio paleaceo (Mitten) A. Jaeger foliis orbicularibus similis, sed costis valde duplicatis, apicibus foliorum graciliter acutis dentatisque, in apice area ex cellulis distinctis hyalinis parietibus tenuibus saepe rhizoidea ferentibus praeditis differt.

Plants medium-sized, to 30 mm long, 4–6 mm wide when wet, soft, yellowish green, glossy, in loose mats; main stems creeping, secondary stems prostrate or slightly ascending, mostly simple, sometimes shortly branched, with leaves strongly contorted when dry; in cross section the outermost layer of stem cells large,

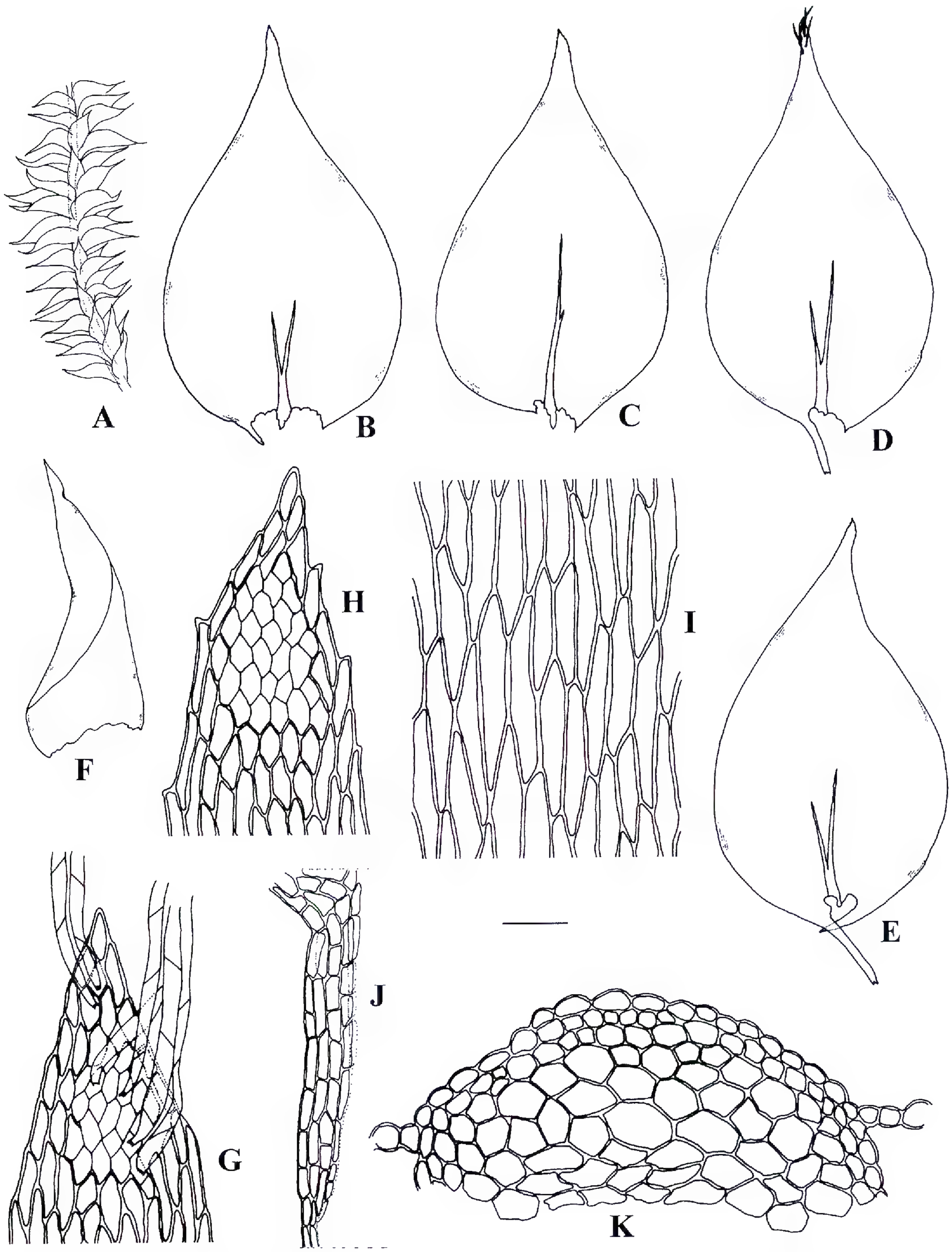

Figure 1. *Plagiothecium shevockii* S. He. —A. Portion of wet plant. —B–E. Leaves. —F. Perichaetial leaf. —G. Leaf apex with rhizoids on abaxial surface. —H. Apical leaf cells. —I. Median leaf cells. —J. Decurrent leaf cells. —K. Portion of stem cross section. All drawn from the holotype, *J. Shevock 18109* (MO). Scale bar = 3 mm (A); 0.55 mm (B–E); 0.20 mm (F); 45 μm (G–I); 80 μm (J); 35 μm (K).

thin-walled, a central strand weakly differentiated; pseudoparaphyllia absent. Stem and branch leaves similar, soft, contorted when dry, distantly spaced, spreading, symmetric, orbicular, 2.8–3.1 × 1.8–1.9 mm, abruptly narrowed to a slenderly acute apex; margins plane, often dentate at the apex; costae strongly double or forked, ca. 1/3–1/2 leaf length, occasionally appearing single; median leaf cells elongate-rhomboidal, thin-walled, smooth, 90–125 × 15–18 μm; apical cells significantly shorter than adjacent cells, 20–30 × 12–14 μm, thin-walled, hyaline, often bearing rhizoids on the abaxial surface; basal juxtacostal cells shorter and broader than median cells; alar regions markedly differentiated, with somewhat enlarged, thin-walled, rectangular cells, strongly decurrent by long, narrow stripes along the stem in 2 to 4 rows and to 12 cells long. Dioicous? Perichaetial leaves shortly ovate-lanceolate. Sporophytes not seen.

Distribution and habitat. *Plagiothecium shevockii* was found at a single locality at a high elevation in *Juniperus* L. forest with *Rhododendron* L. understory along a rocky intermittent stream channel from the outlet of a shallow lake. It was growing on thin soil and litter at the base of a metamorphic rock underhang protected from direct sunlight.

IUCN Red List category. *Plagiothecium shevockii* is currently only known from the type locality. It appears to be rare and restricted to a high mountain area in Taiwan. Only a small patch of population has been discovered. Its IUCN conservation status at this point remains uncertain. The species should be classified as Data Deficient (DD) based on IUCN Red List criteria (IUCN, 2001).

Etymology. The specific epithet honors James Shevock, who has made significant contributions to East Asian bryology in recent years by collecting bryophytes, particularly in Taiwan, as well as mainland China and Korea.

Relationships. *Plagiothecium shevockii* is characterized by its orbicular, symmetric leaves that are suddenly narrowed to slenderly acute leaf apices; strong, double or forked costae (sometimes appearing to be single); and by its dentate leaf apices that have a group of differentiated, thin-walled, hyaline cells. It is similar to *P. paleaceum* from the Himalayas and southwestern China (Yunnan) in having rounded to orbicular leaves, but the latter differs by its much shorter double costae (ca. 1/5 the leaf length); entire, shortly pointed leaf apices that lack groups of differentiated, hyaline, thin-walled cells; and by its narrower median leaf cells (11–14 μm wide). The dentate leaf apices of *P. shevockii* that have a group of differentiated, hyaline, thin-walled cells bearing rhizoids are also seen in the European *P. platyphyllum*. The latter differs from the new species by its irregularly branched stems and ovate-lanceolate, distinctly asymmetric leaves that are shortly pointed at the apex and narrowly recurved at the margins.

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A New Species of *Galactia* (Fabaceae, Papilionoideae) from Central Texas, U.S.A.

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ABSTRACT. *Galactia watsoniana* W. C. Holmes & Singhurst (Fabaceae, Papilionoideae), endemic to the southern part of the Balcones Escarpment of central Texas, is described as new. The new species is distinguished from *G. volubilis* (L.) Britton, its apparent nearest relative, by its solitary and larger flowers (17–22 mm vs. 6–12 mm), strigillose trichomes on plant surfaces, presence of a narrow white border on the leaflet margins, and ovate leaflets with reticulated abaxial surfaces.

Key words: Fabaceae, *Galactia*, Papilionoideae, Texas.

The state of Texas has approximately 298 species of vascular plants that are considered endemic (W. R. Carr, unpublished data), with about 35 of these endemic to the Pleistocene terraces of the lower (southern) rim of the Balcones Escarpment. The area, most often known as part of the Edwards Plateau or Hill Country, is also of substantial botanical interest because of the number of eastern species that are present as relicts. These include such species as *Aquilegia canadensis* L., *Arisaema dracontium* (L.) Schott, *Aristolochia serpentaria* L., *Bignonia capreolata* L., *Hamamelis virginiana* L., *Lindera benzoin* (L.) Blume, *Menispermum canadense* L., *Mitreola petiolata* (J. F. Gmelin) Torrey & A. Gray, and *Viola palmata* L. As a whole, the plateau is highly disturbed, mainly as a result of overgrazing, with the natural vegetation largely being replaced by Ashe juniper (*Juniperus ashei* J. Buchholz). Notable exceptions to this are portions of the canyonlands, the uplands that give rise to such rivers as the Medina, Sabinal, and Guadalupe. A number of drainages occur here that are in near pristine condition.

In 2004, while searching the above areas for new occurrences of the recently named Texas endemic *Prenanthes carrii* Singhurst, O'Kennon & W. C. Holmes (Asteraceae; see Singhurst et al., 2004), an unknown species of *Galactia* P. Browne was discovered at the Love Creek Preserve of the Nature Conservancy of Texas. Subsequent field studies have resulted in discovery of this unknown species at additional sites. It is described as follows.

Galactia watsoniana W. C. Holmes & Singhurst, sp. nov. TYPE: U.S.A. Texas: Bandera Co., Love Creek Preserve of the Nature Conservancy of Texas, sloping terrace of bank of Love Creek near cabin, 13 Aug. 2004, *W. C. Holmes 13069 & J. R. Singhurst* (holotype, BAYLU; isotypes, MO, TEX). Figure 1.

A *Galactia volubili* (L.) Britton corolla longiore (17–22 mm non 6–12 mm longa) et trichomatibus strigillosis non patulo-pilosis differt.

Perennial herbaceous trailing to twining vines; taproots vertical, woody, linear to spindle-shaped, at least 10 × 0.2–1 cm, brown; stems to ca. 1 m or longer, 1–2 mm thick, branched, terete to angled, retrorsely strigillose; internodes 8–10 cm or more, shorter above, nodes densely strigillose. Leaves alternate, pinnately trifoliate; stipules linear to narrowly lanceolate, 1–2.1 mm, antrorsely strigillose, densely so at bases, nerves 3(to 5), essentially parallel, apices narrowed to a slightly rounded apex; petioles 1–4.7 mm, antrorsely strigillose, grooved above; stipels linear, 0.4–1.2 mm, glabrate to sparingly antrorsely strigillose; lateral petiolules (pulvinus) 0.5–1.9 mm, densely spreading-strigillose, terminal petiolules 5–7 mm, antrorsely strigillose, the pulvinus 1–2 mm, densely spreading-strigillose; leaflets ovate, 1.3–2 × 2.7–4.7 cm, pinnately nerved, bases rounded to obtuse to occasionally obscurely subcordate, margins entire, densely antrorsely strigillose and appearing as a narrow white band, apices rounded to an acute apiculation 0.5–1 mm, adaxial surfaces glabrate to moderately antrorse strigillose, the secondary nerves exserted from the surfaces,

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Figure 1. *Galactia watsoniana* W. C. Holmes & Singhurst. Holotype specimen, *Holmes 13069 & Singhurst* (BAYLU).

abaxial surfaces paler in color, antrorsely strigillose, nerves and veinlets exserted from the surface, conspicuously reticulate. Inflorescence axillary, 1-flowered; pedicels 4–10.1 mm, antrorsely strigillose. Flowers 17–22 mm; calyx tubes ca. 6 × 1.5 mm; teeth 4, strigillose, upper 3 lanceolate-triangular, 0.7–1.25 mm, lowest tooth linear to lanceolate, 1.3–1.5 mm; corollas purple to pinkish purple; standard broadly obovate to orbicular, ca. 23 × 15 mm, margins entire, apices deeply emarginate; wings ca.

19 mm, keels 14–15 mm; stamens arranged 9 + 1, the tubes ca. 12 mm, filaments 1–1.5 mm, lone filament ca. 13 mm, anthers ca. 0.5 mm; pistil linear, ca. 20 mm, glabrous, the tip turned upward; stigma capitate. Fruit bracteate, 3.5–4 × ca. 0.5 cm, dehiscent, laterally compressed, outer surfaces brown, antrorsely strigillose, inner surfaces white, cobwebby, apex clawed, the remnants of stigma and style attached to claw; seeds 4 to 6, flattened ellipsoid, glabrous, brown splotched with darker brown, ca. 3.5 × 1.9–3 mm.

Distribution. *Galactia watsoniana* is known only from canyonlands of the upper drainage of the Medina and Sabinal rivers of Bandera County, Texas, U.S.A., and has been collected at elevations from 525–596 m.

IUCN Red List category. *Galactia watsoniana*, or "Watson's milkpea," is currently known from two locations and four occurrences in Bandera County, Texas, all discovered in the past two years. The area of occupation is estimated to be ca. 10 km^2, and the number of individuals is estimated to be less than 100. All currently known occurrences are on protected land (Lost Maples State Natural Area, Love Creek Reserve of the Texas Nature Conservancy) and are secure. The species, which is limited to low terraces of upland rivers and large streams, is expected to occur in suitable areas in this and nearby counties. Judging from present land use patterns, such occurrences would be expected to be in decline. The species may be negatively affected by grazing and alien angiosperm species, and is therefore assessed as Endangered (EN) according to IUCN Red List criteria (IUCN, 2001).

Phenology. Flowering late April to August.

Etymology. The new species is named to honor Geraldine Watson (1925–), botanist, conservationist, author, musician, founder of the Pinelands Research Institute, and one of the impelling forces behind the creation of the Big Thicket National Preserve in southeastern Texas. Geraldine is a beloved friend of both authors. In anticipation of the new species being given a common name, we are assigning it the name of "Watson's milkpea."

Discussion. *Galactia watsoniana* is characterized by its solitary flowers that are 17–22 mm long, which is considered large for the genus. The surfaces of the leaves, stems, flowers, and fruits of the plant are lightly to moderately covered with strigillose trichomes, while the pulvini, stipules, and stipels are densely strigillose. Margins of the leaflets are densely shrouded with these appressed trichomes so as to create an easily visible narrow white border. Undersurfaces of leaflets are reticulated and strigillose. Other species of the genus in the southeastern U.S.A. can be distinguished by their smaller flowers, which are generally less than 14 mm long (see Correll & Johnston, 1970; Isely, 1990), most often arranged in pseudoracemes of (1)2 to 3(6) flowers.

In Correll and Johnston (1970), *Galactia watsoniana* would key to *G. volubilis*, a species characterized by its flowers 6–12 mm long borne in clusters of 1 to 3, herbage (stems, leaves, petioles, bracts, etc.) and fruits covered with spreading hairs, leaves not conspicuously reticulated abaxially, and oval to oblong leaflets lacking a narrow white border at the margins.

At the present time, the *Galactia watsoniana* is known from above 520 m elevation in the headwater areas of the upper Medina River (Love Creek) and Sabinal River (Can Creek), both tributaries of the Nueces River. Most often the species occurs on shaded, gently sloping terraces above the creeks. Vegetation is generally sparse with the major dominant plants being *Quercus muehlenbergii* Engelmann and *Acer grandidentatum* Nuttall. *Diospyros texana* Scheele, *Q. laceyi* Small, *Frangula caroliniana* A. Gray, *Fraxinus texensis* (A. Gray) Sargent, *Juniperus ashei*, and *Tilia americana* var. *caroliniana* (Miller) Castiglione are of lesser occurrence. Shrubs present are *Sophora secundiflora* (Ortega) Lagasca ex DC., *Mahonia trifoliolata* (Moricand) Fedde, *Opuntia* Miller, *Smilax bona-nox* L., and *Vitis monticola* Buckley. The herbaceous flora is dominated by *Nassella leucotricha* (Trinius & Ruprecht) R. W. Pohl. Others include *Packera obovata* (Muhlenberg ex Willdenow) W. A. Weber & Á. Löve, *Verbesina virginica* L., *Viola sororia* Willdenow, *Dichanthelium acuminatum* subsp. *lindheimeri* (Nash) Freckman & Lelong, as well as the endemic taxa *Tragia nigricans* Bush, *Passiflora affinis* Engelmann, *Clematis texensis* Buckley, *Spigelia texana* (Torrey & A. Gray) A. DC., and *Prenanthes carrii* Singhurst, O'Kennon & W. C. Holmes. One specimen of *Galactia watsoniana* (*Holmes 13705 & Singhurst*) was growing from a crevice in a nearly vertical limestone canyon wall.

Paratypes. U.S.A. **Texas:** Bandera Co., Love Creek Preserve of the Nature Conservancy of Texas (LCPNCT), sloping terrace of bank of Love Creek near cabin, 14 May 2006, *Holmes 13532 & J. R. Singhurst* (BAYLU); LCPNCT, 285 m WSW of cabin, 13 Aug. 2004, *Holmes 13051 & J. R. Singhurst* (BAYLU); LCPNCT, upper reaches of Love Creek, 1900 m from type location, 18 July 2006, *Holmes 13705 & J. R. Singhurst* (BAYLU); Lost Maples State Natural Area, Can Creek, 17 May 2006, *Holmes 13557 & J. R. Singhurst* (BAYLU).

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Prockia oaxacana (Salicaceae), una Especie Nueva del Estado de Oaxaca, México

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RESUMEN. Se describe e ilustra *Prockia oaxacana* J. Jiménez Ramírez & Cruz Durán (Salicaceae), una especie nueva de la región mixteca del estado de Oaxaca, México. Es similar a *P. krusei* J. Jiménez Ramírez & Cruz Durán, pero difiere de ésta por ser una planta poligamodioica, tener corteza exfoliante, estípulas con varias glándulas marginales, flores con pétalos, ovario unilocular, placentación parietal y además sépalos del fruto, baya y semillas más pequeños. También se presenta una clave dicotómica para determinar la especie nueva.

ABSTRACT. *Prockia oaxacana* J. Jiménez Ramírez & Cruz Durán (Salicaceae), a new species from the Mixtec region in the state of Oaxaca, Mexico, is described and illustrated. It appears similar to *P. krusei* J. Jiménez Ramírez & Cruz Durán, but differs in being a polygamodioecious plant with exfoliating bark, stipules with marginal glands, flowers with petals, unilocular ovary, parietal placentation, and smaller sepals, berry, and seeds. A dichotomous key to distinguish this new species of *Prockia* P. Browne ex L. is also included.

Key words: Flacourtiaceae, IUCN Red List, Mexico, Oaxaca, *Prockia*, Salicaceae.

En la revisión de los ejemplares de *Prockia* P. Browne ex L. depositados en el Herbario Nacional de México (MEXU) se detectó que algunos especímenes colectados en la región mixteca del estado de Oaxaca estaban erróneamente ubicados en *P. crucis* L., pero al realizar una cuidadosa disección de sus flores, de efectuar nuevas colectas y hacer observaciones de más de 100 flores en campo, se encontró que estos especímenes son diferentes a todas las especies conocidas de dicho género y de los géneros de la tribu Prockiae Endlicher, por ello se les propone como miembros de una especie nueva: *Prockia oaxacana* J. Jiménez Ramírez & Cruz Durán.

El nuevo taxón es poligamodioico (sensu Sousa & Zárate, 1983), ya que algunos individuos tienen flores estaminadas y algunas flores pistiladas, en cambio, otros poseen solamente flores pistiladas. Las flores masculinas presentan pistilodio y las femeninas cuentan con numerosos estambres, pero el polen es deforme y estéril pues no se observa contenido celular. La flor pistilada posee receptáculo piloso, anteras redondeadas con dehiscencia lineal, ovario unilocular con placentación parietal que en fruto es ligera e irregularmente intrusiva, los sépalos verdes, los pétalos verde-amarillentos y ambos verticilos son acrescentes y envuelven al pistilo durante su transformación en fruto maduro, punto en el que vuelven a abrir dejando expuesta a la baya en algo parecido a una "segunda antesis", pero el perianto cambia gradualmente su color original hasta presentar, en la madurez del fruto, un rojo encendido. Las flores estaminadas tienen sépalos verdes y pétalos verde-amarillentos que siempre permanecen del mismo tamaño y color, su receptáculo es piloso, sus anteras son redondeadas con dehiscencia longitudinal y poseen pistilodio.

Al seguir la clave de géneros del Neotrópico de Sleumer (1980) para ubicar al nuevo taxón, se llega a una dicotomía dentro de la tribu Prockiae (opción número 15 de Sleumer, 1980) entre *Pleuranthodendron* L. O. Williams (flores hermafroditas y estilo filiforme) y *Hasseltiopsis* Sleumer (flores unisexuales, individuos dioicos y estilo ausente), pero *Prockia oaxacana* no puede situarse en *Pleuranthodendron* porque no tiene como este género, glándulas entre el pecíolo y la lámina foliar, ni de cuatro a seis sépalos y pétalos, ni glándulas interestaminales, ni placentas fuertemente intrusivas, y tampoco puede ubicarse en *Hasseltiopsis* porque carece de disco, su flor masculina posee pistilodio y tanto este último como el pistilo de la flor femenina presentan un estilo conspicuo (ver Fig. 1), además de ser plantas

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poligamodioicas y no plantas dioicas. Al utilizar la clave de Alford (2003), la disyuntiva crucial se encuentra en la opción número 22 del trabajo citado, ya que ninguna alternativa puede ser elegida indisputablemente para ubicar a la especie nueva, si se sigue por plantas dioicas (opción 23a) el camino lleva a *Hasseltiopsis* (género ya descartado en la discusión anterior), en cambio a través de la opción 22b (que dice plantas con pétalos, inermes y nativas de América), si se elige plantas con flores hermafroditas (opción 22b) se llega a *Banara* Aublet si se omite la ausencia de placentas intrusivas, dado que la especie nueva tiene pétalos (opción 25a), tres sépalos y anteras redondas con dehiscencia longitudinal (opción 26b), pistilo 1- a incompletamente 3- a 8-locular e inflorescencia en racimos (opción 27b). La redacción de esta última opción hace pensar que cuando el pistilo es unilocular no existen placentas intrusivas, pero Alford (2006) señala explícitamente que *Banara* tiene placentas fuertemente intrusivas, al compararla con *Pineda* Ruiz & Pavón.

Banara parece una alternativa interesante para ubicar a *Prockia oaxacana*, pero dicho género posee solamente flores bisexuales, pétalos casi tan grandes como los sépalos, placentas fuertemente intrusivas y perianto no acrescente en el fruto, características ausentes en la especie nueva. Otra posibilidad de inserción es *Prockia* (que aparece en varias dicotomías con *Banara* en la clave de Alford, 2003), porque cuando alguna especie de este género presenta pétalos, son de tamaño reducido como se ve en el nuevo taxón (ver Fig. 1), pero *Prockia* solamente tiene flores hermafroditas, ovarios triloculares y perianto no acrescente. Otra alternativa es *Neosprucea* Sleumer, pues el perianto de una especie es ligeramente acrescente en el fruto (Alford, com. per.) y posee receptáculo piloso, pero sus flores son bisexuales y tetrámeras o pentámeras, su ovario tiene placentas fuertemente intrusivas, estaminodios filamentosos y anteras redondeadas con dehiscencia poricida (peculiaridad señalada por Alford, 2003), mientras que la especie nueva y los dos géneros mencionados en este párrafo, tienen flores esencialmente trímeras (muy rara vez pentámeras o tetrámeras) y anteras redondeadas con dehiscencia longitudinal. Es importante señalar que todos los géneros mencionados pertenecen a la tribu Prockiae.

Prockia krusei J. Jiménez Ramírez & Cruz Durán, del estado de Guerrero, México, es la especie más parecida a *P. oaxacana* ya que tienen hojas, estípulas, flores pistiladas y estaminadas, y frutos muy semejantes, además de compartir el crecimiento del perianto alrededor del pistilo hasta la madurez del fruto, acompañado de una "segunda antesis" que deja expuesta a la drupa y el cambio de color original del perianto a un rojo encendido, de acuerdo a las observaciones hechas durante los años de 2005, 2006 y 2007. Es interesante mencionar que al seguir la clave de géneros de Alford (2003) para determinar a *P. krusei* se llega al género *Prockia*, siempre y cuando se siga la opción 22b del trabajo mencionado (plantas con flores hermafroditas y un solo estilo), lo que lleva a la opción 25a (flores apétalas) y finalmente al número 28b del mismo trabajo (flor con tres sépalos, baya y semillas glabras). La opción 22a de Alford (2003) (plantas dioicas con 4 a 8 estilos o estigmas) no es elegible pues *P. krusei* es androdioica y posee un estilo y un estigma. Sin embargo, todas las especies de *Prockia* son triloculares o 3(a 6)-loculares y *P. krusei* es unilocular, de manera que existe un problema de ubicación genérica similar a *P. oaxacana*.

El cladograma (basado en datos moleculares y morfológicos) (Alford, 2005: 57) divide a la tribu Prockiae en tres clados separados, *Macrohasseltia* L. O. Williams se ubica en una rama junto a géneros como *Olmediella* Baillon, *Salix* L., *Populus* L. entre otros; otro clado incluye a *Hasseltia* Kunth, *Banara kuhlmanii* Sleumer (ahora *Macrothumia kuhlmanii* (Sleumer) M. H. Alford) y *Pleurantodendron*, y finalmente el resto de los géneros de la tribu (*Pineda*, *Hasseltiopsis*, *Neosprucea*, *Prockia* y *Banara*) están en otra rama, pero *Prockia crucis* queda incluida en el grupo interno de las especies de *Banara*, lo que hace pensar a Alford (2005, com. per.) que *Prockia* y *Banara* son polifiléticos. Tradicionalmente, el número de lóculos del ovario y la presencia o ausencia de pétalos han jugado un papel muy importante para separar a *Banara* de *Prockia* (el primer género tiene ovario unilocular con placentas fuertemente intrusivas y los pétalos siempre presentes y el segundo posee ovario trilocular y flores apétalas o con pétalos diminutos), pero en el cladograma mencionado *P. pentamera* A. H. Gentry (con ovario trilocular) es el grupo hermano de varias especies de *Banara* (ovario unilocular) y de *P. crucis* (ovario trilocular). Ante estas circunstancias se hace todavía más difícil ubicar a *P. oaxacana* y *P. krusei* en algún género, ya que el número de lóculos del ovario no es un criterio indisputable para ubicarlas en *Banara* o en *Prockia*, además, de que estos géneros tal vez tengan próximamente nuevas circunscripciones si se confirma la idea de Alford (2005) de que son taxones polifíleticos. Ante este panorama se opta por dejar a las dos especies discutidas dentro de *Prockia*, sin perder de vista que no es una solución satisfactoria y que no es aventurado pensar que estudios futuros las ubiquen en un género nuevo.

Prockia oaxacana J. Jiménez Ramírez & Cruz Durán, sp. nov. TIPO: México. Oaxaca: Distr. Juxtlahuaca,

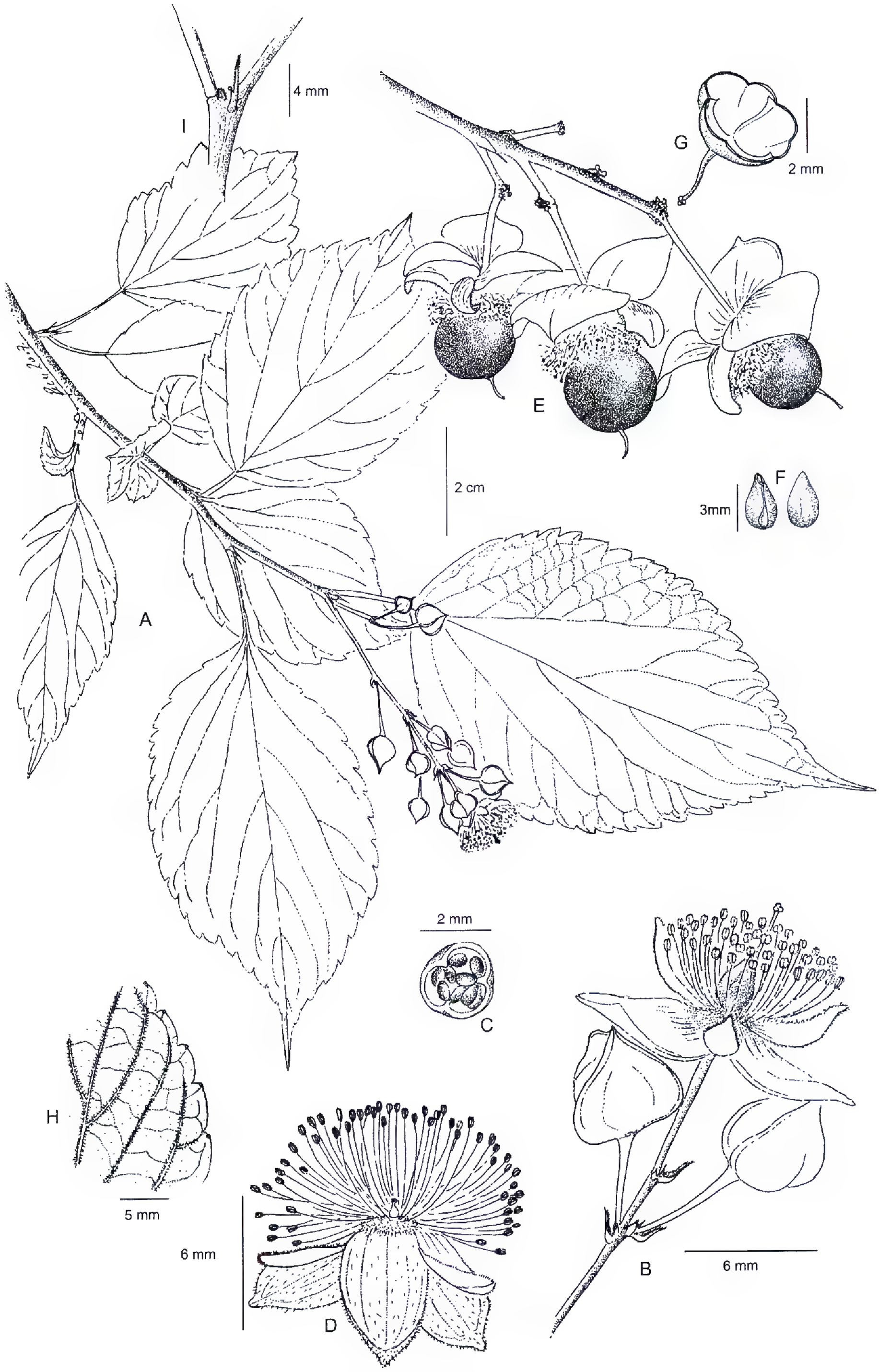

Figura 1. *Prockia oaxacana* J. Jiménez Ramírez & Cruz Durán. —A. Rama con flores hermafroditas. —B. Flor femenina. —C. Placentación de flor femenina. —D. Flor masculina. —E. Frutos. —F. Semillas. —G. Corte de fruto. —H. Venación, envés de la hoja. —I. Estípula. A, B y C de *Jiménez y Vega 1562* (holotipo, MEXU); D, H e I de *Calzada 21037* (MEXU); E y F de *Jiménez y Vega s.n.* (FCME, MEXU); G de *Reyes 464* (MEXU).

Mpio. Santos Reyes Tepejillo, 2 km de Juxtlahuaca sobre el camino a Tepejillo, 30 jun. 2006 (flor pistilada), *J. Jiménez R. y K. Vega F. 1562* (holotipo, MEXU; isotipos, FCME, MO). Figura 1.

Planta polygamodioecia, *Prockia krusei* J. Jiménez Ramírez & Cruz Durán affinis sed cortice in lamellas exfoliante, stipulis glandulis marginalibus praeditis, floribus petalis paratis, ovario 1-loculari sine placentis prominentibus, sepalis fructiferis 1.1–1.5 × ca. 0.9 cm, bacca 0.4(–0.5) × 0.4(–0.5) cm et semine 3 3.5 × ca. 2.5 mm distinguenda.

Arboles o arbustos poligamodioicos (sensu Sousa & Zárate, 1983), (2–)3–6 m de alto, corteza exfoliante en placas, ramas con abundantes lenticelas blancas. *Hojas* ovadas a elípticas; lámina 6.5–9.5(–12.5) × 2–5.5 (–6.5) cm, base redonda, con 5 nervios a la base, hasta 4 venas secundarias, ápice acuminado, margen crenado, con (10)11 a 14(17) dientes por lado, 3–8 mm, ápice de cada diente terminado en una glándula, haz glabro, envés pubescente (sobre todo en las venas principales); pecíolo 0.8–2.2 cm, pubescente; estípulas 2–4 mm, subuladas, persistentes, pubescentes en ambos lados, con algunas glándulas en el margen. *Inflorescencias* racemosas, terminales, las masculinas 3.2–6.5 cm, con hasta 8 flores, raquis pubescente, las femeninas con hasta 15 flores. *Flores* 2 cm (incluyendo pedicelo), pareadas en cada nudo, 3 brácteas en la base de cada par de flores; las flores masculinas con pedicelos 0.6–1.4 cm, pubescentes, articuladas en la base hasta 0.5 mm; receptáculo pubescente, cáliz con 3(4 ó 5) sépalos (ligeramente alados en el botón) 6–7 × ca. 4 mm, verdes, reflejos, triangulares, pubescentes en ambos lados, margen lanoso-pubescente, ápice agudo; pétalos 3(4 ó 5), ca. 4 × 2 mm, verde-amarillentos, elípticos, ciliado-pubescentes en el margen, ápice agudo; estambres amarillos, 75 a 80, 5–6(–7) mm (incluyendo antera y filamento), anteras redondeadas, con dehiscencia longitudinal, ca. 0.6 mm; pistilodio 1–1.5 mm, glabro, ovario unilocular, ca. 0.5 mm diám., con 3 placentas parietales, estilo recto, ca. 1 mm, estigma ligeramente trilobulado; las flores femeninas con pedicelos pubescentes, articuladas hasta 1 mm, sépalos 3(5), 5.5–7 × 5–5.5 mm, verdes, acrescentes y rojos en la fructificación, receptáculo ligeramente pubescente, pétalos 3(5), verde-amarillentos (acrescentes y rojos en la fructificación), estambres (75)80 a 125, anteras redondeadas, polen deforme y estéril (sin contenido celular), pistilo 3–4.5 mm, ovario unilocular, 1.5–2 mm, con 3 placentas parietales, estilo recto, 1.5–2 mm, con 3 estigmas prominentes. *Fruto* una baya globosa, 4(–5.5) × 4(–5.5) mm, negra cuando madura, con pedicelos hasta 1.5 cm, con articulación de hasta 1 mm, sépalos rojos persistentes, acrescentes, 1.1–1.5 × ca. 0.9 cm, pétalos rojos, también persistentes, acrescentes hasta 1 cm de longitud, placentas ligera e irregularmente intrusivas, estilo persistente hasta 3 mm. *Semillas* 3–3.5 × ca. 2.5 mm, negras, subglobosas, 4 a 7 por baya.

Distribución y hábitat. Se distribuye de 1480–1850(–2050) m de altitud en vegetación de bosque de *Quercus* L.–*Brahea* Martius ex Endlicher, bosque de *Pinus* L.–*Quercus*, bosque de *Quercus*–*Juniperus* L., selva baja caducifolia, bosque mixto de *Quercus*, ecotonía entre encinar y palmar y bosque tropical caducifolio. Se asocia a *Alnus* Miller, *Lysiloma* Bentham, *Vernonia* Schreber, *Salix*, *Quercus*, *Pinus*, *J. flaccida* Schlechtendal y *Acacia* Miller, en suelo negro rocoso calizo.

Conservación. En una especie en peligro (EN) bajo los criterios de la UICN (2001), porque se conocen menos de 250 individuos, las poblaciones están fragmentadas, ocupan un área menor a los 500 km cuadrados y su hábitat esta siendo perturbado intensamente por la tala y el pastoreo.

Fenología. Florece de junio a agosto y fructifica de (julio a) agosto a septiembre, a principios de la temporada lluviosa.

Nombre común. Tuchée ntii (mixteco), obs. pers.

Etimología. El nombre de esta especie hace alusión a uno de los estados con mayor diversidad vegetal en México, el estado de Oaxaca.

A continuación se presenta una clave (modificada de Alford, 2003) para distinguir a la especie nueva y se incluyen todos los géneros en que pudiera ubicarse, de acuerdo a lo visto en la primera parte de este trabajo. Se adiciona *Macrohasseltia*, pues aparece en dos alternativas del trabajo de Alford (2003), una con *Banara* y otra con *Prockia*, pero dicho género no tiene parecido morfológico con la especie nueva ni con *P. krusei*, como es posible ver en la clave.

Clave para la Determinación de Géneros de la Tribu Prockieae del Neotrópico (con Excepción de *Hasseltia* y *Piveda*)

1a. Hojas con tricomas estrellados.
  2a. Sépalos y pétalos 3; fruto una baya . . . . . *Banara*
  2a. Sépalos 5 a 6, pétalos ausentes; fruto una cápsula. . . . . *Macrohasseltia*
1b. Hojas glabras o con tricomas simples.
  3a. Glándulas en la base de las hojas o en los pecíolos.
    4a. Estípulas falciformes, dentadas y grandes . . . . . *Prockia*
    4b. Estípulas no falciformes, caducas o inconspicuas.

5a. Anteras lineales con dehiscencia ± poricida; hoja con las tres venas principales generalmente extendiéndose hasta el ápice. . . . . *Neosprucea*
5b. Anteras redondas con dehiscencia longitudinal; hoja con las tres venas principales extendiéndose solamente hasta dos tercios de la longitud de la hoja.
6a. Perianto caduco en el fruto; hojas con dos glándulas que sobresalen de la base de la lámina foliar; pecíolo sin glándulas.
7a. Panículas desorganizadas; fruto con una semilla de hasta 1 cm. . . . . *Pleuranthodendron*
7b. Flores arregladas en fascículos umbeliformes; fruto con muchas semillas de hasta 2 cm. . . . . *Banara*
6b. Perianto persistente en el fruto; hojas sin glándulas en la base de la lámina foliar; pecíolo con una o varias glándulas o glándulas en posición asimétrica.
8a. Flores con 5 sépalos y pétalos . . . . . *Prockia pentamera*
8b. Flores con 3 sépalos y 0 a 3 pétalos.
9a. Ovario 3- a 6-locular, placentas insertas en un pseudoeje; inflorescencias en racimos . . *Prockia*
9b. Ovario 1- a incompletamente 3- a 8-locular; inflorescencias en racimos, panículas o fascículos . . . . . *Banara*
3b. Glándulas ausentes en la base de las hojas o en los pecíolos.
10a. Plantas dioicas; estilo ausente y con 4 a 8 estigmas . . . . . *Hasseltiopsis*
10b. Plantas poligamodioicas, androdioicas o únicamente con flores hermafroditas; con un estilo y un estigma.
11a. Plantas poligamodioicas (unos individuos con flores pistiladas y otros con muchas flores estaminadas y pocas flores pistiladas) o androdioicas.
12a. Tronco principal con corteza que exfolia en placas; plantas poligamodioicas; estípulas con varias glándulas marginales; flores siempre con pétalos (se examinaron más de 100 flores en unos 20 individuos vivos); ovario sin placentas intrusitas; sépalos en el fruto 1.1–1.5 × ca. 0.9 cm; baya 0.4(–0.5) × 0.4(–0.5) cm, y semillas 3–3.5 × ca. 2.5 mm . . . . *Prockia oaxacana*
12b. Tronco principal con corteza ligeramente fisurada, no exfoliante; plantas funcionalmente androdioicas; estípulas con una glándula apical y rara vez con una glándula lateral; flores generalmente apétalas a muy rara vez con un solo pétalo (al examinar poco más de 100 flores de unos 20 individuos vivos se encontró algunas pocas con un solo pétalo); ovario con placentas ligeramente intrusivas; sépalos en el fruto 1.5–1.8 × 1.2–1.8 cm; baya ca. 0.9 × 0.9 cm y semillas 3.5–4 × ca. 2.5 mm . . . . . *Prockia krusei*
11b. Plantas con flores hermafroditas.
13a. Pétalos presentes.
14a. Sépalos 4 a 5; anteras lineares y con dehiscencia ± poricida. . . . . *Neosprucea*
14b. Sépalos 3; anteras redondas con dehiscencia longitudinal.
15a. Ovario 3- a 6-locular, placentas insertas en un pseudoeje; inflorescencia en racimos . . . . . *Prockia*
15b. Ovario 1- a incompletamente 3- a 8-locular; inflorescencia en racimos, panículas o en fascículo . . . . . *Banara*
13b. Pétalos ausentes.
16a. Sépalos 5 a 6; fruto una cápsula, semillas con pelos parecidos a algodón . . *Macrohasseltia*
16b. Sépalos 3; fruto una baya ± seca, semillas glabras. . . . . *Prockia*

Prockia oaxacana y *P. krusei* no se pueden confundir con ninguna otra especie de Prockiae porque reunen un conjunto único de características, como el ser plantas poligamodioicas o androdioicas, perianto acrescente que rodea totalmente al pistilo hasta su transformación en fruto y sufrir una "segunda antesis" cuando abren para dejar expuesta a la baya, además de cambiar su color original a un rojo encendido, sin dejar de considerar que su ovario puede tener placentas no intrusivas o placentas ligeramente intrusivas. La especie nueva y *P. krusei* tienen hojas, estípulas, flores y frutos muy parecidos, pero se pueden distinguir entre sí porque la primera posee corteza exfoliante en placas, sus individuos son poligamodioicos y sus flores siempre tienen 3 (rara vez 4 ó 5) pétalos (luego de examinar más de 100 flores) y la segunda posee corteza no exfoliante, sus individuos son androdioicos y sus flores son generalmente apétalas (al examinar más de 100 flores, sólo unas pocas presentaban solo un pétalo), entre otras características que pueden verse en la clave anterior.

Paratipos. MÉXICO. **Oaxaca:** Distr. Juxtlahuaca, Mpio. Santos Reyes Tepejillo, a 4 km al N de Santos Reyes Tepejillo, senda antigua hacia San Miguel Tlacotepec, *I. Calzada 21037, 21129, 22131* (MEXU), *I. Calzada y Clevinger 19984* (MEXU), 2 km de Juxtlahuaca, camino a Tepejillo, *K. Vega s.n.* (FCME), *J. Jiménez y K. Vega s.n.* (FCME, MEXU), Mpio. San Miguel Tlacotepec, senda Caliente y Pitayo, entrando por San Miguel Tlacotepec, *I. Calzada 20176* (MEXU), Mpio. San Juan Mixtepec (vieja cañada), 1.12 km al E de San Juan Mixtepec, *Reyes 421* (MEXU), río Mixteco, 6 km al NO de San Juan Mixtepec, *J. Reyes 464* (MEXU), cañada entre el Km 24 y 25 del camino entre Huajuapan de León y Tamazulapan, *K. Vega 1124, 1125, 1126, 1127 y 1128* (FCME), entre el Km 24 y 25 de carr. Acatlán–Oaxaca, entre Reforma y Tamazulapan, *K. Vega 1163, 1164, 1165, 1166, 1167 y 1168* (FCME).

Agradecimientos. A Mac H. Alford por sus valiosos comentarios y observaciones sobre las

Salicaceae del Neotrópico, además de proporcionar varios de sus trabajos sobre la familia mencionada; a un revisor anónimo sus valiosos comentarios; a Hilda Flores, directora del Herbario Nacional de México (MEXU), quien otorgó facilidades para la consulta del material de herbario; a Ma. del Rosario García Peña, técnico académico del MEXU, por su diligencia para preparar el préstamo de material de herbario de MEXU del género *Prockia*; a Martha Martínez Gordillo por la diagnosis en latín, además de su cuidadosa revisión del trabajo; y a Susana Valencia Ávalos la revisión critica al manuscrito. Finalmente, a José Antonio Hernández Gómez de Microcine, Facultad de Ciencias, UNAM, la digitalización de la Figura 1.

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Una Nueva Especie de *Marsdenia* (Apocynaceae, Asclepiadoideae) de la Región de Chamela Cuixmala del Estado de Jalisco, México

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RESUMEN. *Marsdenia magallanesiana* Juárez-Jaimes, una nueva especie del estado de Jalisco, es descrita e ilustrada, se compara con *M. edulis* S. Watson y *M. callosa* Juárez-Jaimes & W. D. Stevens, que son las especies más similares morfológicamente. Las tres especies crecen en áreas separadas de las selvas bajas caducifolias del Pacífico mexicano. Sin embargo, la nueva especie se distingue por no presentar callos carnosos en los senos de lo lóbulos de la corola, por los lóbulos de la corona suborbiculares con los márgenes sin engrosamientos y por el apéndice estilar subcónico con el ápice corto ligeramente dividido.

ABSTRACT. *Marsdenia magallanesiana* Juárez-Jaimes, a new species from the state of Jalisco, Mexico, is described and illustrated here; it is compared with *M. edulis* S. Watson and *M. callosa* Juárez-Jaimes & W. D. Stevens, which are the morphologically most similar species to it. The three species grow in separate areas of the tropical deciduous forest of the Pacific slopes of Mexico. However, the new species is distinguished by the absence of a fleshy callus on the corolla sinus lobes, its corona lobes suborbicular with margins not thickened, and its style appendage subconic with a short, slightly divided apex.

Key words: Apocynaceae, Asclepiadoideae, IUCN Red List, Jalisco, *Marsdenia*, tropical deciduous forest.

Marsdenia magallanesiana Juárez-Jaimes, sp. nov. TIPO: México. Jalisco: Mpio. La Huerta, ca. de la playa Los Negritos, camino a la Huerta, 19°31′N, 105°04′W, 15 m, 28 jul. 2002, *V. Juárez, E. González, S. Zaragoza, O. Delgado y E. Ramírez 682* (holotipo, MEXU; isotipo, MO). Figura 1.

Species nova a *Marsdenia eduli* S. Watson appendice stylari subconica, apice brevi leviter diviso, coronae lobulis suborbicularibus, marginibus non incrassatis, a *M. callosa* Juárez-Jaimes & W. D. Stevens callo carnoso in quoque sinu lobulorum corollinorum nullo recedit.

Enredaderas herbáceas en el crecimiento nuevo, leñosas en las partes viejas; tallos cafés suberosos, glabrescentes, lenticelados, con látex blanco, partes subterráneas desconocidas. Hojas opuestas, láminas elípticas, 3.5–6.7 × 1.8–2.6 cm, ápice agudo, base obtusa a redondeada, glabras, nervios laterales 6 a 8 pares, coléteres 4 a 6 pares; pecíolo 0.6–1.5 cm, glabrescente. Inflorescencia 1 por nudo, umbeliforme-compacta, con 18 a 20 flores, glabrescente, pedúnculo 2–4 mm, pedicelo 2.5–3 mm. Cáliz con 1 coléter por seno, lóbulos suborbiculares, 1.3–2.5 × 1.3–2.3 mm, con ápices obtusos, abaxialmente rugoso-puberulentos, adaxialmente glabros, márgenes enteros; corola blanco-cremosa, cortamente campanulada, carnosa, sin callos carnosos en los senos de los lóbulos, con un penacho inconspicuo de pelos dorados opuestos a los lóbulos de la corola, tubo 2–2.2 mm, glabro por dentro, lóbulos ovados 2–2.6 × 1.3–2 mm, con ápices obtusos y emarginados, adaxialmente y abaxialmente glabros, márgenes enteros; ginostegio sésil, 1.2 mm; lóbulos de la corona suborbiculares, 0.6–0.8 × 0.8–0.9 mm, carnosos, completamente fusionados al ginostegio, ápices redondeados, márgenes sin engrosamientos, lisos; corpúsculo 0.2–0.3 mm, elipsoidal, polinios globosos a piriformes, 0.3–0.4 mm; apéndice estilar subcónico, 0.7–0.9 × 0.8–0.9 mm, con ápice corto ligeramente dividido. Folículo desconocido.

Discusión. Marsdenia magallanesiana comparte con *M. edulis* y *M. callosa* varias características como son hojas elípticas y glabrescentes; inflorescencias umbeliformes-compactas, pedúnculos y pedicelos de menos de 5 mm de largo; corolas campanuladas, blanco-cremosas, glabras, carnosas y lóbulos de la corona muy cortos y sencillos morfológicamente.

Sin embargo *Marsdenia magallanesiana* se distingue de *M. edulis* (Fig. 2D–F) por su corola cortamente campanulada, apéndice estilar subcónico con el ápice corto ligeramente dividido, lóbulos de la corona suborbiculares, márgenes sin engrosamientos; su distribución se restringe al estado de Jalisco, en altitudes por debajo de los 100 m de la región Chamela Cuixmala. Esta región es reconocida por Lott y Atkinson (2002) como una de las zonas de selva baja caducifolia con mayor diversidad florística de México y donde el género *Marsdenia* R. Brown, dentro de las lianas, es uno de los más importantes. Por su parte *M.*

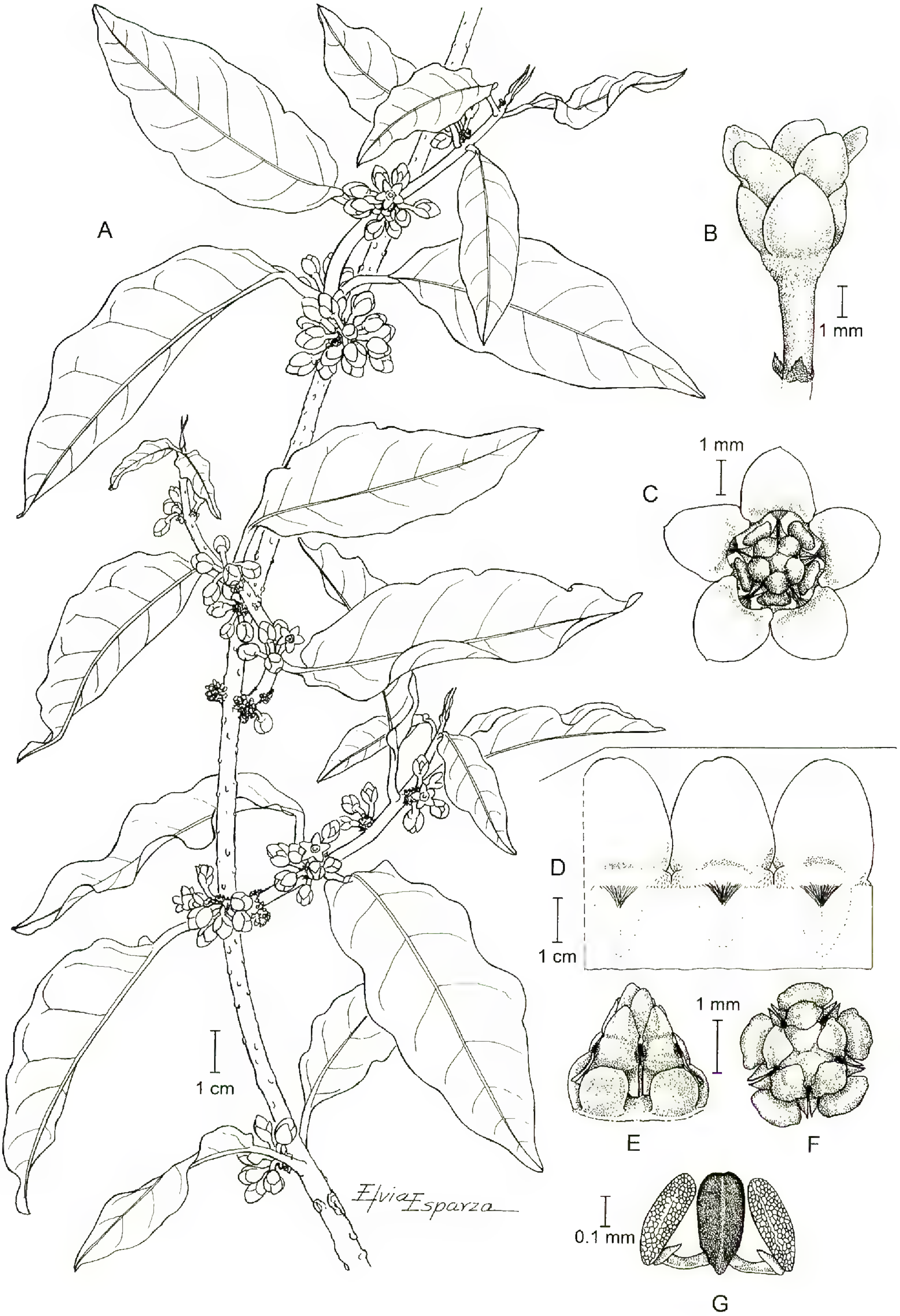

Figura 1. *Marsdenia magallanesiana* Juárez-Jaimes. —A. Rama con inflorescencias. —B. Vista lateral de la flor. —C. Vista apical de la flor. —D. Vista adaxial de la corola. —E. Vista lateral del ginostegio mostrando los lóbulos de la corona suborbiculares sin márgenes engrosados y apéndice estilar subcónico. —F. Vista apical del ginostegio. —G. Polinario. Dibujo del holotipo *V. Juárez et al. 682* (MEXU).

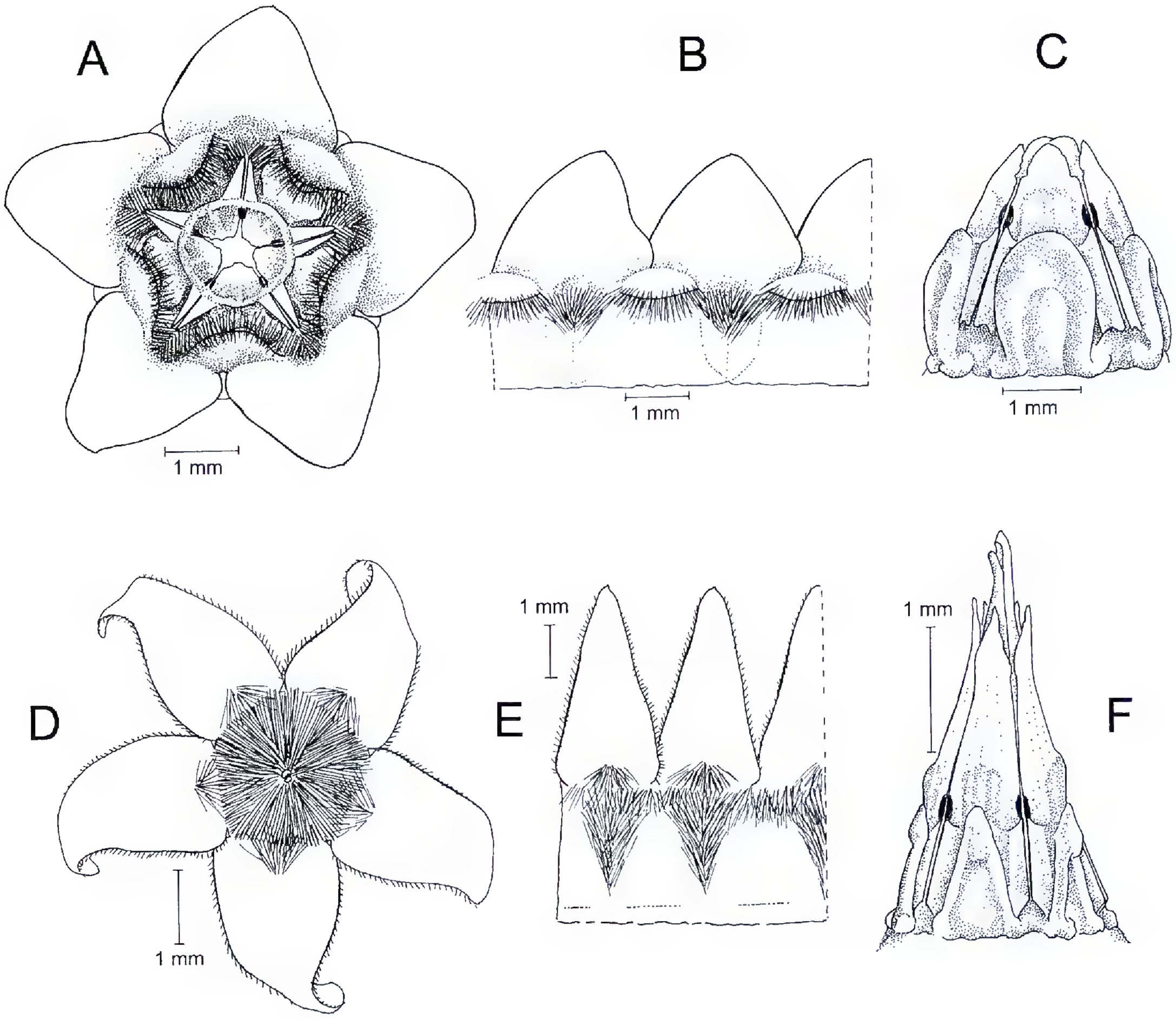

Figura 2. A–C. *Marsdenia callosa* Juárez-Jaimes & W. D. Stevens. —A. Vista apical de la flor. —B. Senos de los lóbulos de la corola con callos carnosos en la superficie adaxial. —C. Vista lateral del ginostegio mostrando los lóbulos de la corona con márgenes engrosados. Dibujo del holotipo *V. Juárez et al. 620* (MEXU). D–F. *Marsdenia edulis* S. Watson. —D. Vista apical de la flor. —E. Pubescencia de la garganta de la corola en la superficie adaxial. —F. Vista lateral del ginostegio mostrando el apéndice estilar cónico con el ápice dividido. Basado en *P. Tenorio 4625* (MEXU).

edulis presenta como características distintivas (Fig. 2D–F) corola tubular, apéndice estilar cónico, rostrado, con el ápice dividido, lóbulos de la corona sagitados, con márgenes engrosados. Se distribuye desde el norte de Jalisco y los estados de Nayarit, Sinaloa y Sonora, en selva baja caducifolia y aún en matorral xerófilo, llegando hasta los 700 m.

Por otro lado *Marsdenia magallanesiana* se distingue de *M. callosa* (Fig. 2A–C) por la ausencia de un callo carnoso en cada seno de los lóbulos de la corola, mientras que *M. callosa* tiene un callo carnoso en los senos de los lóbulos de la corola (Juárez-Jaimes & Stevens, 1997). Con una distribución más al sur de México, en las selvas bajas caducifolias de los estados de Michoacán, Guerrero y Oaxaca en altitudes que pueden llegar hasta 700 m. *Marsdenia edulis* fue una especie erróneamente reconocida como de amplia distribución a lo largo de las selvas bajas caducifolias del Pacífico mexicano.

Marsdenia callosa, *M. magallanesiana* y *M. edulis* forman un pequeño grupo morfológico dentro de la subsección *Edules* propuesta por Rothe (1915), no sólo por su gran parecido vegetativo, sino por la forma y glabrescencia de sus hojas, inflorescencias reducidas y lóbulos de la corona sencillos y cortos los cuales nunca sobrepasan las anteras; cada una de ellas creciendo hasta el momento en diferentes áreas de distribución de las vertientes del Pacífico mexicano.

Conservación. En este momento el estatus de conservación de *Marsdenia magallanesiana* usando el criterio de la UICN (2001) es estimado como En Peligro (EN B1a) pues la extensión de la presencia estimada es menor de 100 km^2 y su distribución es fragmentada.

Fenología. Florece de mayo a julio.

Etimología. El epíteto específico se dedica a Arturo Solís Magallanes, maestro del Centro Universitario, Costa Sur de la Universidad de Guadalajara, por su importante contribución al conocimiento de la Flora de la Estación de Biología Chamela de la Universidad Nacional Autónoma de México.

Paratipos. MÉXICO. **Jalisco:** Mpio. La Huerta, Km 52 carr. Barra de Navidad–Puerto Vallarta, 19°30′N, 105°03′W, 50 m, *G. Ayala 776* (Herbario de la Estación de Biología Chamela); vic. of Chamela & Cuitzmala, Costa Careyes N of Rancho Cuixmala on Puerto Vallarta–Barra de Navidad, Mex. Hwy. 200, 19°27′N, 105°02′W, *G. Ayala 204* (MEXU); Las Alamandas, Río San Nicolas, 19°38′N, 105°12′W, *S. H. Bullock* 1884 (MEXU).

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Arthrostylidium berryi (Poaceae, Bambusoideae, Bambuseae, Arthrostylidiinae), a New Species from White Sand Shrublands in Venezuela and Colombia

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Abstract. *Arthrostylidium berryi* Judziewicz & Davidse (Poaceae, Bambusoideae, Bambuseae, Arthrostylidiinae), a new species from riversides, seasonally flooded white sand shrublands, and granitic lajas in lowland Venezuela and adjacent Colombia, is described and illustrated. It is easily distinguished from its South American congeners in *Arthrostylidium* Ruprecht by its strongly reflexed leaf blades and long (4–10 cm) spikelets with numerous (nine to 15) florets.

Resumen. Se describe e ilustra una especie nueva, *Arthrostylidium berryi* Judziewicz & Davidse (Poaceae, Bambusoideae, Bambuseae, Arthrostylidiinae), de Venezuela y Colombia, que crece en la cuenca del Río Orinoco, en zonas arbustivas, periódicamente inundables, sobre arenas blancas y lajas graníticas. Esta nueva especies se distingue fácilmente de todas las especies Sudamericanas del género *Arthrostylidium* Ruprecht, por tener las láminas foliares y caulinares muy reflejas y las espiguillas largas (4–10 cm) con antécios más numerosos (nueve a 15).

Key words: Arthrostylidiinae, *Arthrostylidium*, Bambuseae, Bambusoideae, Colombia, IUCN Red List, Orinoco, Poaceae, South America, Venezuela.

Of 52 published names in *Arthrostylidium* Ruprecht (Poaceae, Bambusoideae, Bambuseae, Arthrostylidiinae), we currently recognize 32 species. An additional 14 species are recognized as belonging to other genera (*Ampelocalamus* S. L. Chen, T. H. Wen & G. Y. Sheng, *Aulonemia* Goudot, *Chusquea* Kunth, *Colanthelia* McClure & E. W. Smith, *Guadua* Kunth, and *Rhipidocladum* McClure). The genus occurs throughout tropical America (Judziewicz, 1990, 2004; Judziewicz & Clark, 1993; Londoño & Clark, 1998; Renvoize, 1998; Judziewicz et al., 1999, 2000) and includes 17 South American species, of which 12 have been recorded from either Colombia or Venezuela. However, there are clearly additional new taxa known only from sterile or fragmentary material. In the Guayana Highlands of Venezuela, there are four described and at least four undescribed species of *Arthrostylidium*.

One of these, recently treated as *Arthrostylidium* sp. D in the *Flora of the Venezuelan Guayana* (Judziewicz, 2004: 36–38), has now been collected in flowering condition from the lowlands of the upper Orinoco River drainage of Venezuela and adjacent Colombia. The strongly reflexed leaf blades (culm and foliage) of the new species are more typical of the mid- to high-elevation arthrostylidioid genus *Aulonemia* (Judziewicz et al., 1999). However, the new taxon is otherwise congruent with the current circumscription of *Arthrostylidium* based on its stout, thick-walled culms with a promontory and one to several equal branches present at each node; racemose inflorescences; and lowland habitat preference. A parallel discordance occurs in *Arthrostylidium auriculatum* Londoño & L. G. Clark (Londoño & Clark, 1998), which has prominent leaf sheath auricles (a character not otherwise seen in *Arthrostylidium* but found in many *Aulonemia*). Clearly, generic limits in the Arthrostylidiinae are problematic and await study by molecular techniques. In any event, *Arthrostylidium* is the type genus of the subtribe established by Soderstrom and Ellis (1987), and it seems advisable to propose the new species in that genus at present. The following description is based on specimens examined from MO, NY, US, UWSP, and VEN.

Arthrostylidium berryi Judziewicz & Davidse, sp. nov. TYPE: Venezuela. Amazonas: Laja Suiza, first granitic outcrop upstream from mouth of black-water Río Guasacavi on N (rt.) side, 3.5 km SSW of Santa Cruz (direct air distance),

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depression next to seasonally flooded shrub savanna, 3°14′18″N, 67°24′30″W (GPS), 100 m, 3 Mar. 1996, *P. E. Berry, G. A. Romero & L. Brako 5866* (holotype, VEN; isotypes, MO [3], TFAV not seen, UWSP). Figures 1, 2.

Bambusa lignosa. Culmi usque ad 3 m longi, 3–5 mm diam. Laminae foliorum 11–16 × 1–1.6 cm, valde, reflexae. Racemi spiciformes, 15–30 cm longi, spiculas 12 ad 20 gerentes. Spiculae 4–8(–10) cm longae, puberulentes, flosculos 9 ad 15 gerentes; glumae lanceolatae, acutae; gluma I 4–6 mm, 3- ad 5-nervis, gluma II 6–8 mm, 7- ad 9-nervis; lemmata 9–11.5 × 1.3–2 mm, lanceolata, acuta.

Densely to loosely tufted woody bamboo, the rhizomes sympodial; *culms* erect or (reportedly in *Galeano et al. 5968*) semi-erect or clambering, to 3 m long; internodes rigid, reed-like, hollow with a small lumen to 1/3 the culm diam., puberulent to less commonly glabrous, smooth to scabrous (especially below the nodes), 3–5 mm diam., rigid; nodal line slightly annular, corky; bud solitary, positioned ca. 1–2 mm above the nodal line; *primary bud* slight promontory, producing 1 or 2 subequal widely spreading branches, these rebranching or not. *Culm leaves* smaller than but otherwise not much differentiated from foliage leaves, the sheaths 3–5 cm, the blades 3–4 × 1–1.3 cm, strongly reflexed, deciduous; *foliage leaves* in complements of 11 to 17; *sheaths* glabrous and granular to puberulent; *inner ligule* to 1 mm or sometimes nearly lacking, membranous, brown; *outer ligule* rimlike, 0.1 mm; *fimbriae* few, delicate, golden brown, erect to slightly spreading, 4–9 mm or occasionally absent; *pseudopetioles* 1.5–5 mm, brownish green; *blades* 11–16 × 1–1.6 cm, linear-lanceolate, usually strongly reflexed, the uppermost in the complement sometimes spreading or uncommonly erect, obtuse to truncate and symmetrical to slightly asymmetrical at the base, acuminate at the apex, puberulent and with a marginal green stripe on the lower (abaxial) surface, the upper (adaxial) surface slightly scaberulous, the margins scabrous with scattered antrorse prickles. *Inflorescence* a terminal spicate raceme 15–30 cm, alternately bearing 12 to 20 erect, appressed, short-pedicelled spikelets on a puberulent rachis; *peduncles* 4–10 cm; *pedicels* 1–2 mm. *Spikelets* 4–8(–10) cm, linear, deciduous above the glumes and between the florets, puberulent throughout, olivaceous or stramineous to reportedly greenish maroon (*Guánchez 363*), 9- to 15-flowered, the uppermost floret rudimentary; *glumes* lanceolate, acute, awnless, persistent, membranous, keeled above the middle; lower glume 4–6 mm, 3- to 5-nerved, the upper glume 6–8 mm, 7- to 9-nerved; rachilla internodes separating the upper glume from the lower floret 2–3 mm; florets 9–11.5 × 1.3–2 mm, lanceolate, membranous becoming indurate, brownish green, deciduous, overlapping so that the apex of one floret reaches about the middle of the floret above it; *lemma* keeled, (9 to)11- to 13(to 15)-nerved, the apex acute, awnless; *palea* 8–11 mm, as long as or slightly longer and protruding from the lemma, bicarinate or also with 2 faint nerves; *lodicules* and *stamens* not seen; *pistil* with 2 stigmas. *Caryopsis* (immature) to 5.8 mm.

Distribution and habitat. *Arthrostylidium berryi* is a shrubby species that occurs in dense, semi-shaded thickets along streams, in seasonally flooded white sand shrublands (arbustales), and on outcrops or lajas in the drainage of the Río Orinoco and tributaries in far southern Venezuela (Amazonas) and adjacent Colombia (Guainía), at elevations from 80–200 m. At the type locality (Fig. 3), the species grows in a sandy depression alongside a granitic rock outcrop, close to the banks of the Río Guasacavi, a black-water river. The area is rich in white-sand endemics (Anderson, 1981), and directly across the river is the type locality of *Anaxagorea inundata* P. E. Berry & R. B. Miller (Annonaceae; Berry et al., 1999). Other associates include *Steyermarkochloa angustifolia* (Sprengel) Judziewicz (Poaceae), *Spathanthus bicolor* Ducke (Rapateaceae), *Thurnia polycephala* Schnee (Thurniaceae), *Securidaca retusa* Bentham (Polygalaceae), *Curtia obtusifolia* (Bentham) Knoblauch (Gentianaceae), and *Retiniphyllum pauciflorum* Kunth ex Krause (Rubiaceae) (Paul E. Berry, pers. comm.). The other localities of the new species are in the same general drainage basin of the Río Atabapo, all of them in areas that must be seasonally flooded in the local wet season (May to November).

IUCN Red List category. Using IUCN Red List criteria (IUCN, 2001), *Arthrostylidium berryi* would not be considered to be threatened at this time. It occurs over an area of at least 50,000 km² in at least 11 locations, there is apparently no great human pressure on its habitat, there is no evidence of a decline in populations, and much of the area has not been explored botanically. The species could conceivably fall into the Near Threatened category, but we provisionally assign the species status as Data Deficient (DD).

Etymology. We take great pleasure in naming this species for Paul E. Berry (b. 1952), who, together with Bruce Holst and Kay Yatskievych, worked so energetically and effectively to complete the Flora of the Venezuelan Guayana project begun by Julian A. Steyermark.

Discussion. Besides its strongly reflexed leaf blades (Fig. 1D), unique in *Arthrostylidium*, the new species has the longest spikelets of any South

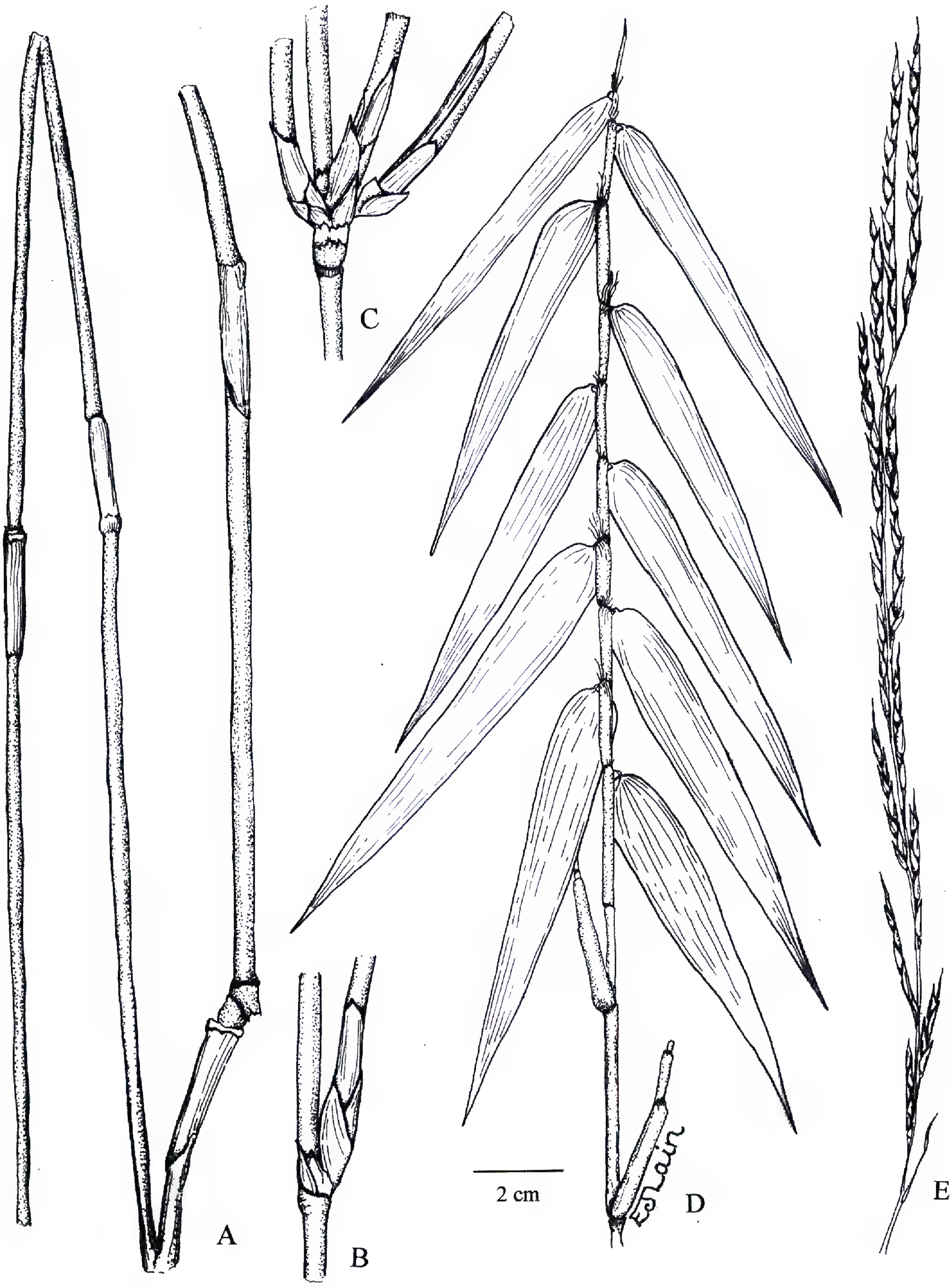

Figure 1. *Arthrostylidium berryi* Judziewicz & Davidse. —A. Culm. —B, C. Branching complements at mid-culm nodes, showing promontory. —D. Foliage leaf complement showing reflexed blades. —E. Inflorescence. Drawn from isotype *Berry et al. 5866* (UWSP) by Emily J. Lain.

American species in the genus. In the most recent key to South American species of *Arthrostylidium* (Londoño & Clark, 1998: 409–410), *A. berryi* would not key out: it would fit somewhere between couplets 11 and 12 and be distinguished by its combination of large spikelets 4–8(–10) cm long, numerous (nine to 15) florets, and narrow leaf blades only 1–1.6 cm wide; it could most easily be added to that key by

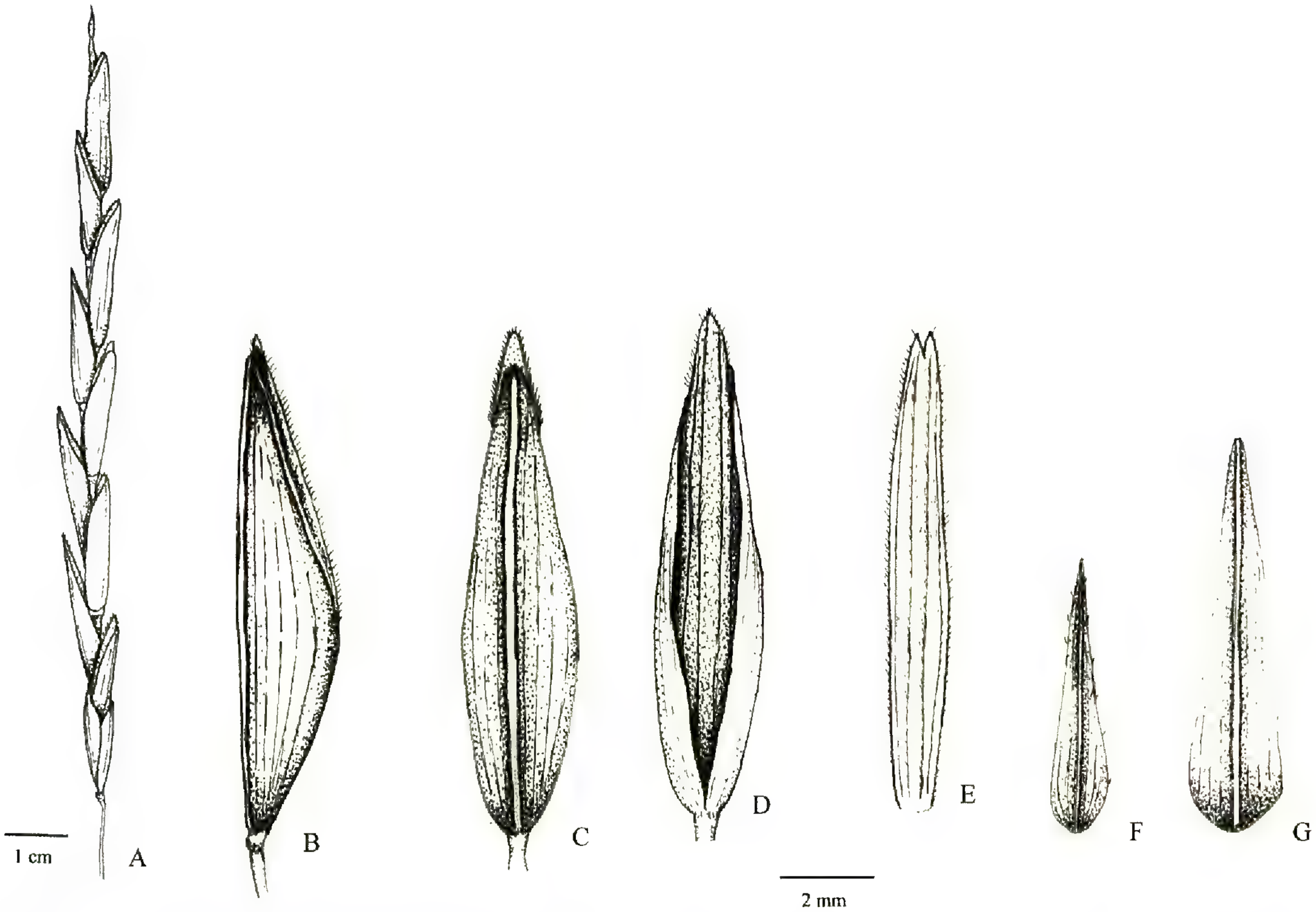

Figure 2. *Arthrostylidium berryi* Judziewicz & Davidse. —A. Spikelet, lateral view. —B. Lower glume. —C. Upper glume. —D. Floret, lateral view. —E. Floret, dorsal view. —F. Floret, ventral view. —G. Palea, ventral view. Drawn from isotype *Berry et al. 5866* (UWSP) by Emily J. Lain.

Figure 3. Type specimen co-collector Lois Brako with *Arthrostylidium berryi* Judziewicz & Davidse in understory at type locality at Laja Suiza, Río Guasacavi, Amazonas, Venezuela, 3 March 1996. Photograph by Paul E. Berry.

bringing it out first, based on its strongly reflexed leaf blades.

There are several other collections of *Arthrostylidium* from the Department of Amazonas, Venezuela, in the upper Orinoco Basin that may pertain to *A. berryi* or related species and merit citation and discussion here. All are sterile: Depto. Atabapo y Casiquiare, a lo largo del Río Atacavi, del Caño Caname y del Río Atabapo, 3°05′–3°50′N, 66°50′–67°30′W, 10–24 Nov. 1980, *P. Piñate & E. Mondolfi 1002* (US, VEN). This specimen differs from typical *A. berryi* in its distinctly scabrous (rather than smooth or slightly scabrous) culms and larger (up to 18 × 2.5 cm) foliage leaf blades. Another sterile bamboo, perhaps a seedling of *A. berryi*, is known from Amazonas, Venezuela, on the Río Guasacavi at 3°14′00″N, 67°23′38″W, less than 1 km from the type locality, 6 Mar. 1996 (*P. Berry, G. A. Romero & L. Brako 6014*, MO, VEN). It consists of a series of sterile specimens only 30 cm tall with very strongly reflexed leaf blades only 4–8 × 0.3–0.5 cm. The culms are smooth and puberulent, and delicate fimbriae are present on the leaf sheath summits.

Paratypes. COLOMBIA. **Guainía:** Mpio. Puerto Inirida, resguardo indígena Almidón–La Ceiba, Caño Caimán, orilla izquierda, 3°37′N, 67°57′W, 22 Mar. 1998, *G. Galeano, P. Franco, J. Murillo, J. Jácome & I. Gil 5968* (COL, MO); near Coitara, ca. 7 km S of San Fernando de Atabapo (Venezuela), W bank of Río Atabapo, 3°55′N, 67°43′W, ca. 95 m, 29 Apr. 1979, *G. Davidse 16832* (MO, US). VENEZUELA. **Amazonas:** Laja Suiza, first granitic outcrop upstream from mouth of black-water Río Guasacavi on N (rt.) side, 3.5 km SSW of Santa Cruz (direct air distance), 3°14′18″N, 67°24′30″W (GPS), 3 Mar. 1996 [sterile], *P. E. Berry, G. A. Romero & L. Brako 5866a* (MO); Laja Jabua, granitic outcrop on E bank of Río Temi, several km from mouth, 3°12′33″N, 67°22′29″W (GPS), 23 Nov. 1995, *P. E. Berry, R. Duno & G. A. Romero 5562* (MO); Dept. Atabapo, ca. 20 km S of San Fernando de Atabapo on E bank of Río Atabapo, 3°50′N, 67°39′W, 29 Apr. 1979, *G. Davidse, O. Huber & S. S. Tillett 16852* (MO, US); same locality, uncommon, distinctly longer than *16852*, 29 Apr. 1979, *G. Davidse, O. Huber & S. S. Tillett 16853* (MO, US); Depto. Atabapo, entre el medio Caño Yagua y el bosque al N del Cerro Cucurito, 3°37′N, 66°34′W, 18 Jan. 1979 [sterile], *O. Huber 3128* (MO, US, VEN); Dept. Río Negro, lower part of Río Baria, 1°10–27′N, 66°25–32′W, 22–23 July 1984, *G. Davidse 27644* (MO, US); Depto. Casiquiare, ribera W del Caño Pimichín, un poco al S del Caserío Pimichín, 2°50′N, 67°33′W, 110 m, 24 Feb. 1979, *O. Huber 3398* (MO, US, VEN); Dept. Río Negro, Mamurividi, Zona 10 Est. Climat. del Min. del Amb. on Río Pacimoni, 1°32′N, 66°32′W, 3 Apr. 1984, *R. Liesner 17184* (MO, US); Depto. Atures, 5 km N de Caserío San Pedro de Cataniapo, "laja" del Cerro Uchonhua, 60 km al SE de Puerto Ayacucho, 5°41′N, 67°11′W, n.v. "jibaju" (Guahiba), *F. Guánchez 363* (US, VEN); ca. 1 km W of Budare, on S bank of upper Río Temi, 14 km (direct air distance) SW of Yavita, 2°52′15″N, 67°19′00″W (GPS), 10 Mar. 1996, *P. E. Berry, G. A. Romero & L. Brako 6183* (MO, VEN).

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A New Species of *Leucheria* (Asteraceae, Mutisieae) from Chile

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Abstract. A new species of *Leucheria* Lagasca (Asteraceae, Mutisieae), *L. graui* Katinas, M. C. Tellería & Crisci, with glutinous habit and yellow corollas is described and illustrated. This would be the only species within *Leucheria* with yellow corollas. The pollen of the new species is also described and illustrated; it belongs to the *Oxyphyllum* Philippi pollen type and has similar characteristics to other species of *Leucheria*. The new species appears to be morphologically close to *L. apiifolia* Philippi, which belongs to the relatively primitive *L. glacialis* (Poeppig ex Lessing) Reiche evolutionary line of dry environments.

Key words: Asteraceae, Chile, IUCN Red List, *Leucheria*, Mutisieae.

The genus *Leucheria* Lagasca comprises 47 species distributed from Peru to the Falkland Islands (Islas Malvinas) in Argentina (Crisci, 1976). These plants belong to the subtribe Nassauviinae (Asteraceae, tribe Mutisieae, or subfamily Mutisioideae; Jeffrey, 2007; Katinas et al., in press), which is characterized by its genera with capitula florets all bilabiate; the styles cleft into two truncate branches, each branch with an apical crown of rounded papillae; and the exine of the pollen grains distinctly bilayered, with the ectosexine and the endosexine clearly columellate (Crisci, 1974; Tellería et al., 2003). The species of *Leucheria* are typically distributed in the Andes, in extra-Andean areas of Chile, and in the Patagonian steppe. *Leucheria* is distinguished from other members of Nassauviinae by its herbaceous habit, paleae in the capitula of some species, involucre in two or more series, glabrous receptacle, florets rarely yellow, and capillary pappus in one series, frequently plumose. The pollen grains of *Leucheria* are of the *Oxyphyllum* Philippi pollen type, with the ectosexine and endosexine of the same thickness, separated by a thin internal tectum in zigzag, a characteristic shared with the genera *Nassauvia* Commerson ex Jussieu, *Triptilion* Ruiz & Pavón, and *Polyachyrus* Lagasca (Crisci, 1974). Recent molecular studies (Katinas et al., 2008) show a sister relationship between *Leucheria* and *Polyachyrus*, and both are sister of *Moscharia* Ruiz & Pavón.

The species described here—*Leucheria graui* Katinas, M. C. Tellería & Crisci—was discovered around Laguna del Maule in central Chile, during a field trip of the German botanist Jürke Grau. The striking characteristic of this new species is the yellow color of the corollas, a very rare feature since all the species of *Leucheria* described until now have white, pink, red, purple, or blue corollas. Also, *L. graui* is one of the few species of *Leucheria* covered exclusively with glandular hairs, since most species have white lanose pubescence (frequently the nonglandular hairs are mixed with glandular hairs).

Leucheria graui Katinas, M. C. Tellería & Crisci, sp. nov. TYPE: Chile. Región VII, Prov. Maule: Laguna del Maule, rocas al O de la laguna, 2300 m, 25 Jan. 1981, *J. Grau 2893* (holotype, LP; isotypes, CONC, M not seen). Figures 1, 2.

Ab *Leucheria apiifolia* Philippi differt folii lobis profundis, angustioribus, floribus 50 ad 60, flavescentibus, et fructus trichomatibus distinctus ex cellulis 4 compositis.

Perennial, caulescent herbs, 15–30 cm tall, stems striate, densely glandulose. Leaves simple, bipinnatisect, basal leaves in a rosette, upper leaves alternate, herbaceous, densely glandulose on both surfaces, glandular hairs uniseriate, margin planate, sessile, pseudopetiolate, pinnately veined, veins conspicuous

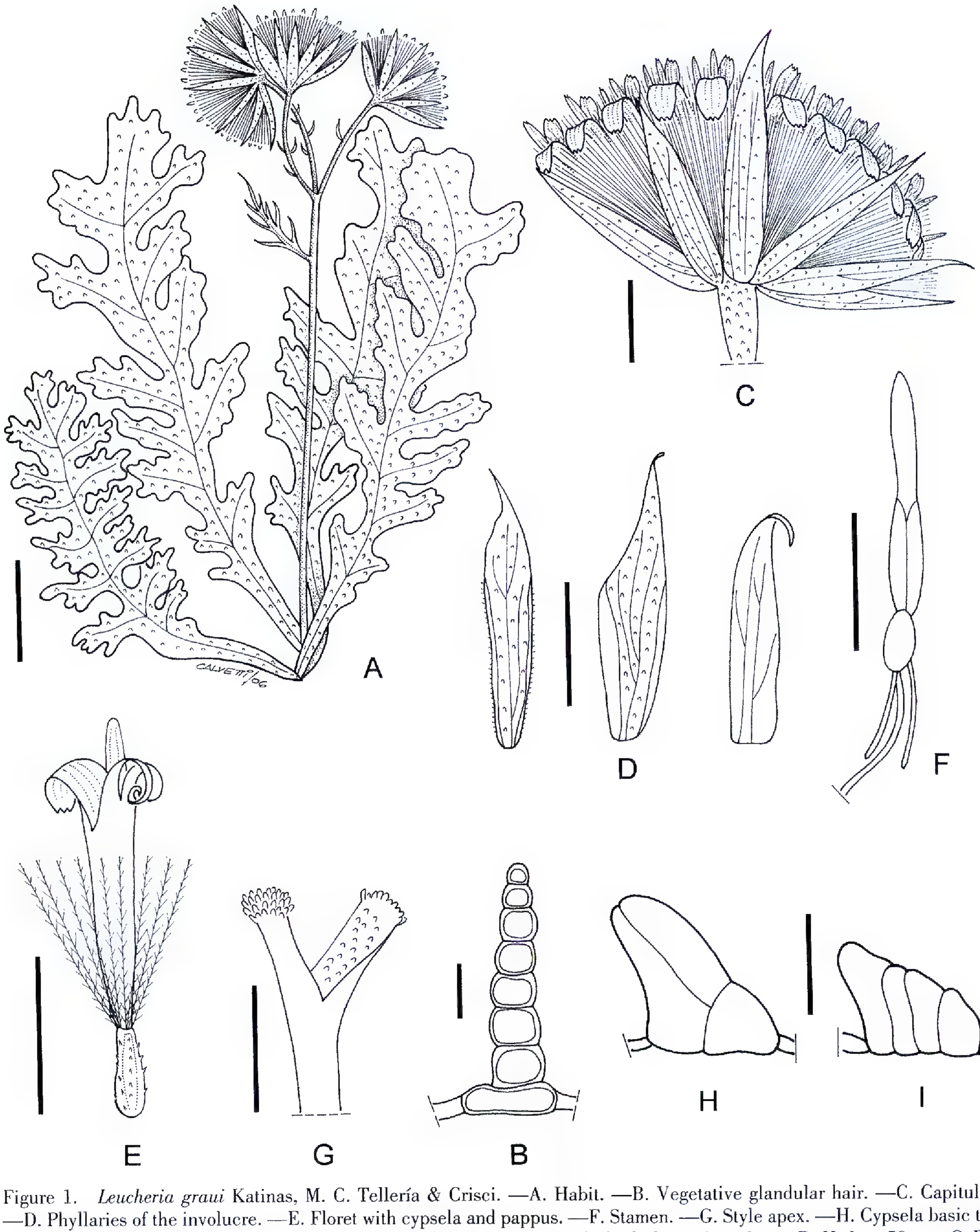

Figure 1. *Leucheria graui* Katinas, M. C. Tellería & Crisci. —A. Habit. —B. Vegetative glandular hair. —C. Capitulum. —D. Phyllaries of the involucre. —E. Floret with cypsela and pappus. —F. Stamen. —G. Style apex. —H. Cypsela basic twin hair. —I. Cypsela crenate twin hair. From the holotype *Grau 2893* (LP). Scale bars: A = 2 cm; B, H, I = 50 μm; C–E = 5 mm; F = 2 mm; G = 1 mm.

on both surfaces; blades oblong to elliptic, 6–17 × 1.5–8 cm, segments narrowly oblong, narrowly oblanceolate, or oblanceolate, pinnatifid to pinnatisect, 0.5–3.5 × 1.5–2 cm, apex acute or acuminate. Capitulescences corymbose; capitula hemispheric, 12–15 × 15–26 mm, homogamous, discoid, pedunculate, peduncle bracteate; receptacle naked; involucre 2- or 3-seriate, 10–11 × 16–30 mm, phyllaries narrowly oblong to elliptic, long attenuate at the apex, margin shortly ciliate, veins purple, first series 5 to 7, 10–13 × 1.5–3 mm, scarious at the margins, glandulose, second series 2 to 5, 10–12 × ca. 2 mm, glandulose, scarious at the margins, third series 0 to 3, 10–12 × 1.5–2 mm, glabrous, completely scarious. Florets isomorphic, bisexual, 50 to 60 per capitulum, corollas bilabiate, yellow, tube 4–8 mm, outer lip

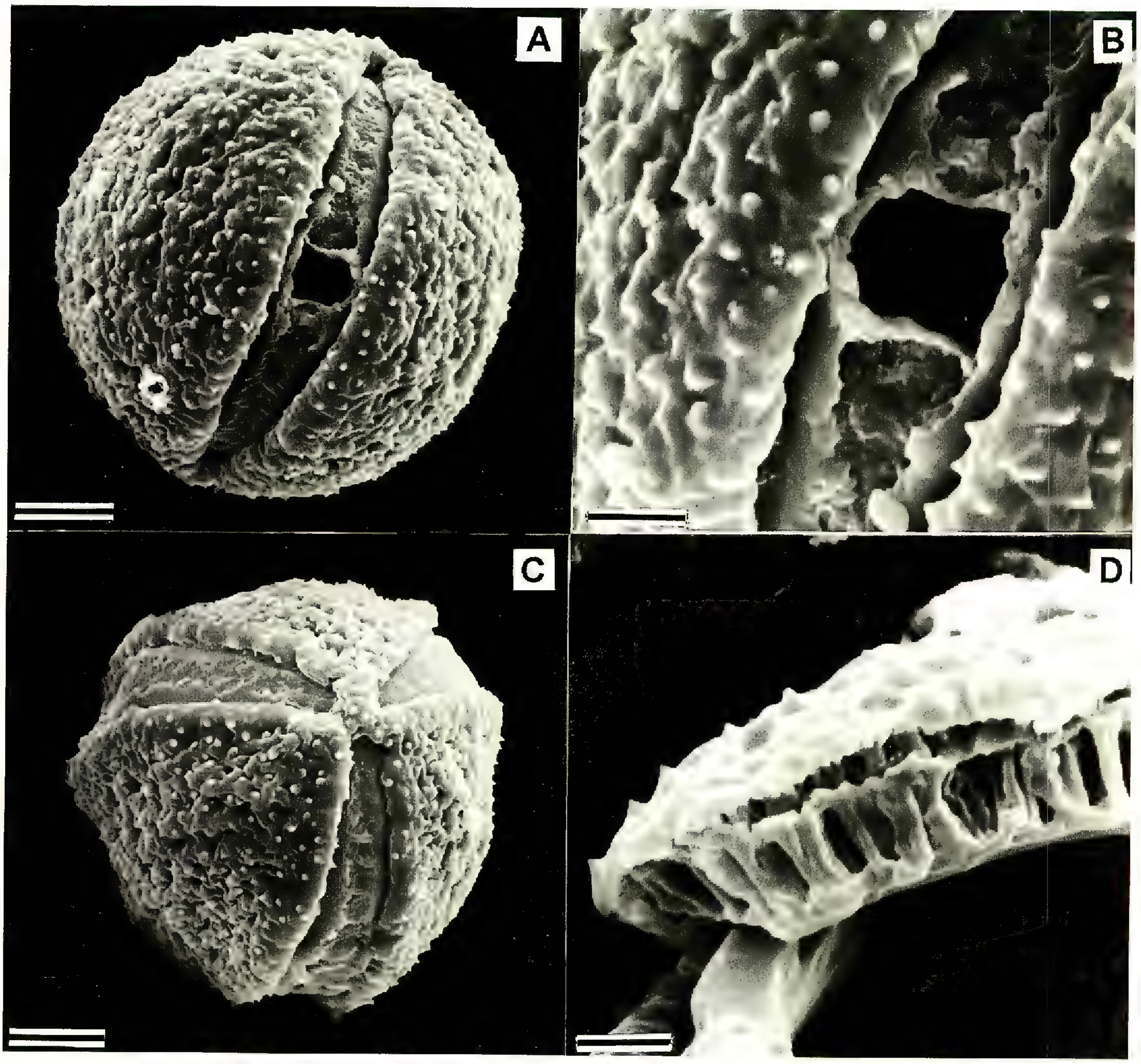

Figure 2. Pollen of *Leucheria graui* Katinas, M. C. Tellería & Crisci. —A. Equatorial view. —B. Detail of aperture and pollen surface. —C. Polar view. —D. Exine structure from a broken grain. From the holotype *Grau 2893* (LP). Scale bars: A, C = 5 μm; B, D = 2 μm.

3-toothed, 4–7 mm, inner lip bifid, 4–7 mm; stamens inserted in the corolla throat, anthers 4–5.5 mm, apical appendage lanceolate, acute, tails smooth, ca. 2 mm, conspicuous antheropodium in the insertion of the filament to the anthers; style 8–9 mm, cleft into 2 truncate branches, each branch 1–1.5 mm, with an apical crown of rounded papillae, nectariferous disc at the base of the style. Cypselae (immature) 2–2.5 mm, constricted at the apex by an epigynous disc, 5-costate, pubescent (typical and atypical twin hairs, rarely glandular hairs biseriate); pappus 6–6.6 mm, uniseriate, bristles united at the base, capillary, plumose.

Pollen (light microscopy) spheroidal to subprolate, spheroidal in equatorial view, circular in polar view, medium size, polar diameter × equatorial diameter = 29–35 × 28–32 μm; tricolporate, colpi long, with microgranulate membrane; endoaperture lalongate; exine *Oxyphyllum* type, 3 μm thick, nexine thickened at level of endoaperture; pollen (SEM) surface imperforate, microechinate, with rugulate aspect; colpi entirely covered with scabrate membrane.

Distribution and habitat. *Leucheria graui* is known only from the type location in rocky places around the Laguna del Maule in central Chile, at about 2300 m in elevation.

IUCN Red List category. This species is only known by a single collection (the type specimens). The plant is very scarce and grows exclusively in the volcanic rock crevices around Laguna del Maule in Chile (Jürke Grau, pers. comm.); therefore, according to the IUCN Red List criteria (IUCN, 2001), *Leucheria graui* should be included in the category Vulnerable (VU).

Table 1. Characters that distinguish *Leucheria graui* from *L. apiifolia*.

	L. graui	*L. apiifolia*
Leaf segments	narrowly oblong, narrowly oblanceolate, or oblanceolate	widely oblong
No. of florets	50 to 60	ca. 36
Corolla color	yellow	white
Cypsela trichomes	basic and crenate twin hairs, rarely glandular hairs	basic twin hairs and glandular hairs
Pappus		
Bristles	filiform-paleaceous, 0.05–0.10 mm wide, straight	filiform, ca. 0.05 mm wide, twisted at the apex
Cilia of bristles	long (0.30–0.50 mm)	short ([0.20–]0.25[–0.30] mm)

Etymology. *Leucheria graui* is named in honor of the German botanist Jürke Grau (b. 1937), an expert on the flora of Chile and collector of the type.

Discussion. *Leucheria graui* can be distinguished by its glutinous appearance, sweet scent, and yellow florets. Anatomically, it can be also distinguished from the other species of *Leucheria* by the presence of crenate twin hairs in the cypselae (Freire & Katinas, 1995); these are characterized by their four hair cells that are cylindrical and united by their longitudinal walls (Fig. 1I). This type of hair can be also found in *Acourtia* D. Don, another member of the subtribe Nassauviinae (Freire & Katinas, 1995).

The closest species to *Leucheria graui* is *L. apiifolia*, endemic to Curicó, Región VII, in Chile; they resemble each other in their caulescent habit, corymbose capitulescence, and glandular pubescence. The species differ in characters of leaves, florets, cypsela, and pappus (Table 1). *Leucheria graui* is also close to *L. salina* (Rémy) Hieronymus, which inhabits northwestern and western Argentina and central Chile. *Leucheria graui* differs by the stems sparsely foliose at the base, larger involucres (10–11 × 16–30 mm), and yellow corollas. The pollen exine type, shape and size of the pollen grains, and aperture features of *L. graui* are very similar to those of the other species of *Leucheria*.

Crisci (1976) distinguished nine evolutionary lines within *Leucheria*. The new species belongs to the *L. glacialis* (Poeppig ex Lessing) Reiche line, constituted by *L. apiifolia*, *L. congesta* D. Don, *L. glacialis*, *L. landbeckii* (Philippi) Reiche, *L. paniculata* Poeppig ex Lessing, and *L. runcinata* D. Don. This line consists of caulescent plants, generally with numerous capitula (three to 20). According to Crisci (1976), the *L. glacialis* line is relatively primitive and probably evolved from the *L. thermarum* (Philippi) Philippi evolutionary line (*L. coerulescens* J. Rémy, *L. magna* Philippi, and *L. thermarum*) from *Nothofagus* Blume (southern beech) forests. The members of the *L. glacialis* line inhabit dry areas north of the *Nothofagus* forests, above 2000 m in Chile and Argentina.

Acknowledgments. We thank Diego G. Gutiérrez for a critical reading of this manuscript and Hugo Calvetti for preparation of the illustrations. Thanks are also due to Vicki Funk, one anonymous reviewer, and the scientific editor of *Novon*, Victoria C. Hollowell. The John Simon Guggenheim Foundation (LK), the National Geographic Society (grant #7646-04), and Consejo Nacional de Investigaciones Científicas y Técnicas are also acknowledged.

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Pusillanthus (Loranthaceae), a New Monotypic Genus from Venezuela

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Abstract. A new monotypic genus of Loranthaceae, *Pusillanthus* Kuijt, is described and illustrated from Venezuela, based on *Phthirusa trichodes* Rizzini. It contrasts with other genera of small-flowered Neotropical Loranthaceae in combining an umbellate capitulum, tetramery, bisexual flowers with nearly sessile anthers, the absence of epicortical roots, and the presence of a conspicuous indument. The other genera have racemic or spike-like inflorescences (rarely solitary, axillary flowers). Species in the genus *Struthanthus* may represent the closest relatives, differing in their versatile anthers, 6-merous flowers, epicortical roots, and (except a single, unrelated Bolivian species) lack of indument; however, that genus is believed to be paraphyletic.

Key words: IUCN Red List, Loranthaceae, *Pusillanthus*, Venezuela.

The species *Phthirusa trichodes* Rizzini (Loranthaceae) was first reported by Rizzini (1956) as *P. guyanensis* Eichler, an error corrected in subsequent publications (Rizzini, 1975, 1982). Its type specimen and other reported specimens were collected in Venezuela, but Rizzini (1982) also cited it from extreme northeastern Brazil (Paraíba), some 2600 km to the west of the type locality, which would seem to be an unlikely outlier. In the meantime, the species has also been collected in Guyana (*Clarke 3729*, as cited below). The apparent rarity of the species may well be a collection artifact, as it would seem to be very inconspicuous.

My study indicates that the species is not appropriately placed in *Phthirusa* Martius or indeed in any other extant genus of Loranthaceae. Study of the diverse plants that have in the past and present been assigned to *Phthirusa* has convinced me that the species represents an isolated taxon that warrants separate generic status.

Rizzini's writing on the sex distribution of the species is inconsistent. In the protologue to *Phthirusa trichodes* (Rizzini, 1975), he speaks of separate male and female flowers, the specimen citations implying dioecy. However, in his treatment for the *Flora de Venezuela* (Rizzini, 1982: 55) he speaks of "flores polígamas," and writes that fruits and pollen-bearing flowers may be found on the same plant. The anthers of a single flower are said to produce pollen or not, and those in the latter condition are referred to as staminodes. The RB holotype is stated to be male, but Rizzini (1982: 55) notes the Brazilian collection from Paraíba as female (*J. Coelho de Moraes 1011*, RB).

In my own dissections, I have found all flowers to be bisexual, and all anthers observed were normal, pollen-bearing ones. Because the flowers and, consequently, the anthers (less than 0.5 mm long) are extremely small, I conclude that Rizzini's observations or material were incomplete—in other words, that the species is characterized by bisexual flowers. This fact has significant taxonomic consequences.

There are several features that separate the species from those normally included in *Phthirusa*. All *Phthirusa* species produce epicortical roots at the base of the plant, and also sometimes from branches; *P. trichodes* lacks any such organs and instead develops a simple, saddle-like haustorial attachment (Fig. 1E). Its capitulate inflorescence has no counterpart elsewhere in *Phthirusa*. The stamens also contrast strongly with those of the common *Phthirusa* species in being isomorphic and lacking the characteristic filament depressions (see the illustrations in Kuijt [1986: 161, fig. 20] and Kuijt & Kellogg [1996: 49, fig. 11]). (The remainder of *Phthirusa*, however, is not uniform in this regard). Tetramerous flowers elsewhere in *Phthirusa* are rare, and present only in species clearly unrelated to *P. trichodes*. All other known species that, now or in the past, have been included in *Phthirusa* are glabrous throughout, while *P. trichodes* has a distinctive indument on all ramifications.

Alternatively, the genus *Struthanthus* Martius could be suggested as a repository for *Phthirusa trichodes*, but it also fails the test. *Struthanthus* is uniformly dioecious, its flowers are hexamerous, and its stamens are versatile and dimorphic, bearing four pollen sacs. No known species of that genus has a capitulum, all having either a spike or raceme, and only one species, a quite unrelated Bolivian one (*S. lewisii* Kuijt), has a recognizable indument (Kuijt, 2003). *Struthanthus* flowers are several times as large as those of *P. trichodes*. Only one other

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Figure 1. *Pusillanthus trichodes* (Rizzini) Kuijt. —A. Habit. —B. Inflorescence, subtending leaf, and fruit. —C. Mature bud and dissected flower. —D. Petal and subtended stamen. —E. Haustorial saddle of mature flowering plant. Scale bars: A = 1 cm; B = 1 mm; C, D = 1 mm; E = 1 cm. A, E drawn from *Ferrari G. 1927* (LEA); B–D drawn from *Clarke 3729* (LEA).

species of *Struthanthus*, the unrelated Argentine *S. llanensis* Ruíz Leal (Ruíz L., 1956), is said to lack epicortical roots, although this fact needs to be confirmed. Finally, *P. trichodes* contrasts with both *Phthirusa* and *Struthanthus* in its foliar anatomy (Kuijt & Lye, 2005): it lacks any kind of sclerenchyma and the cristarque cells that characterize practically all studied species of either genus.

In consequence, I propose the following, with an amended description for the one species.

Pusillanthus Kuijt, gen. nov. TYPE: *Pusillanthus trichodes* (Rizzini) Kuijt [= *Phthirusa trichodes* Rizzini].

Plantae minores, caulibus et inflorescentiis gracilibus, omnino praeter folia pilis obtectis, foliis tenuibus, oblanceolatis. Inflorescentiae omnes axillares, singulae, triadibus duabus sessilibus; flores sessiles, petalis 4, staminibus isomorphis.

Pusillanthus trichodes (Rizzini) Kuijt, comb. nov. Basionym: *Phthirusa trichodes* Rizzini, Revista Fac. Agron. (Maracay) 8(3): 92. 1975. TYPE: Venezuela. Lara: Distr. Palavecino, dry forest betw. Terepaima & Cabudare, 500–900 m, 10 Aug. 1970, *J. A. Steyermark, F. Delascio & G. & Y. Dunsterville 103648* (holotype, RB; isotypes, MO, VEN). Figures 1, 2.

Delicate, branched parasitic shrubs, shoots to 1 m, attached to the host by a saddle-shaped primary haustorium 2–5 cm diam.; epicortical roots absent; stems terete, lateral ones subtended by a few short, obtuse scale leaves, the oldest stems densely covered by small, pustule-like lenticels; young shoots with dense, short, straw-colored, simple hairs, especially at the base of the petiole. Leaves to 25 × 6 mm, thin, glabrous or nearly so, with at least 3 basal veins running nearly the length of the blade; petiole 1 mm, blade narrowly oblanceolate, base acute, apex obtuse to rounded. Inflorescence solitary in leaf axil, to 1 cm, peduncle extremely slender; flowers 6, sessile, crowded at the tip in 2 sessile triads forming a capitulum, with very small (ca. 1 mm) bracts and bracteoles. Flowers bisexual, bud ca. 1.5 mm, calyculus smooth, petals 4, ca. 1 mm, isomorphic; stamens isomorphic, anthers ca. 0.5 mm, on very short, thick, tapered filaments, style straight, stigma capitate, with somewhat papillate surface; pollen ca. 25 µm diam., radially symmetrical, triangular, oblate to suboblate, isopolar, syncolpate, with psilate to somewhat rugulate sculpturing. Fruit (immature) at least 2 mm, ellipsoid, said to be orange or red (Figs. 1, 2).

Distribution, habitat, and IUCN Red List category. *Pusillanthus trichodes* is found in arid regions of Lara, Táchira, and Portuguesa (Venezuela), and in dense forest and brown sand in southwestern Guyana from 180–1600 m. A single collection is reported from Paraíba, Brazil, at least 2700 km east of the Guyana collection (Rizzini, 1975). I have been able to study images of the two RB sheets of this collection, and Rizzini's determination of this remarkably disjunct collection appears to be correct. At present, *P. trichodes* can be assessed only as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001), and its conservation status remains to be investigated.

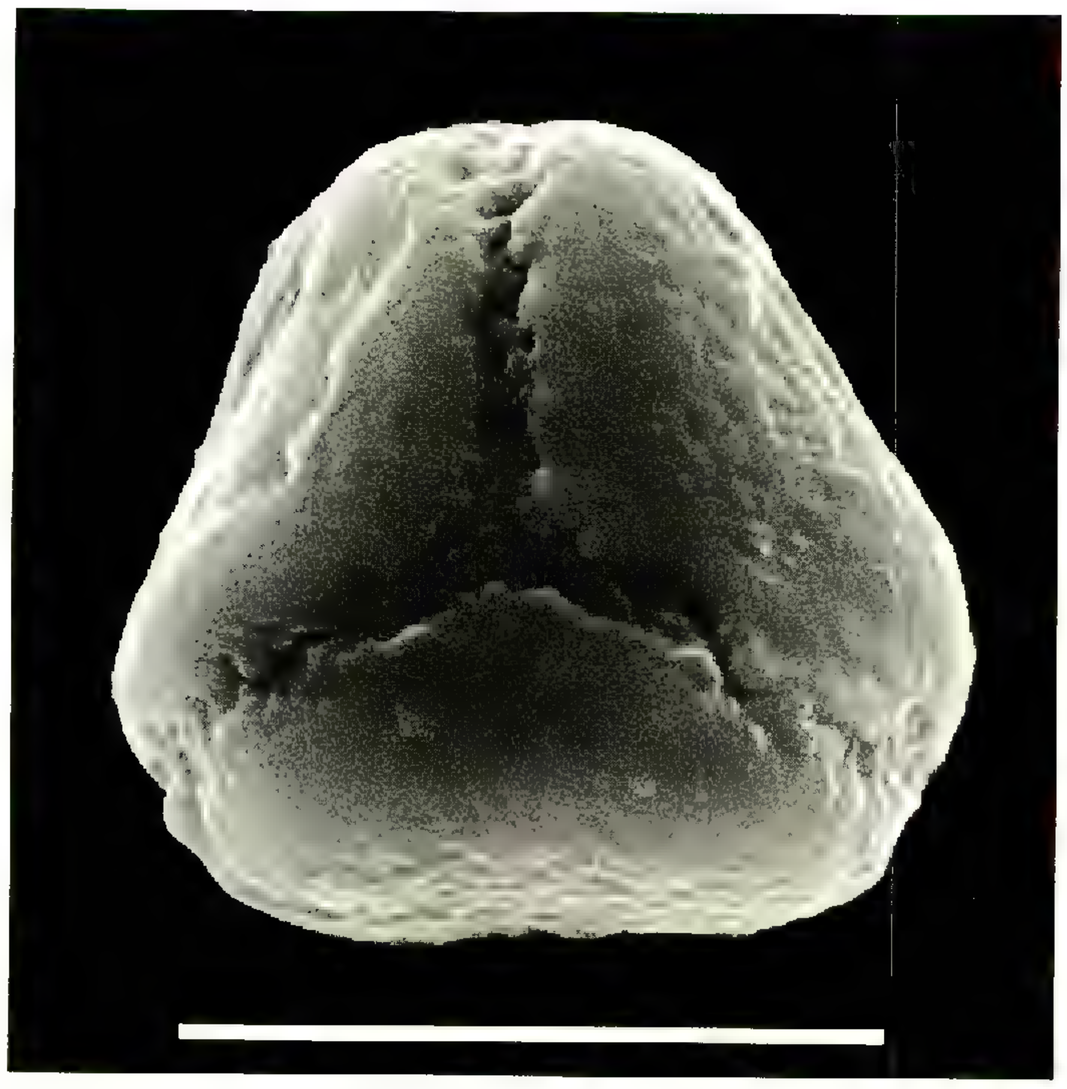

Figure 2. *Pusillanthus trichodes* (Rizzini) Kuijt. Polar view of pollen grain (*Clarke 3729*, LEA). Scale bar = 45 µm.

Relationships. The palynological features as listed above, as well as the triadic nature of the inflorescence, suggest a relationship to especially *Phthirusa* and *Struthanthus* (Feuer & Kuijt, 1985). However, *Pusillanthus* shows a unique combination of characters in its inflorescence structure, indument, tetramerous flowers, haustorial attachment, and anther morphology.

Paratypes. GUYANA. **Upper Takutu–Upper Essequibo Region**: Rewa River, forest 4 km W of camp, betw. camp & unnamed mtn., 2.59′N, 58.35′W, 180 m, *I. Clarke 3729* (LEA, US). VENEZUELA. **Lara**: foothills of Terepaima, 600 m, "sobre Oregano," 20 July 1981, *Ferrari G. 1927* (LEA). **Táchira**: Distr. Lobatera, La Cazadora, 72.18′W, 7.55′N, 1600 m, 21 July 1983, *H. van der Werff & R. Ortíz 5419* (LEA, MO, VEN).

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A New Combination in *Piptochaetium* (Poaceae, Stipeae) from Chile

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Abstract. The new combination, *Piptochaetium depressum* (Steudel) C. Peña, is proposed for the Poaceae (Stipeae) based on lemma shape and ornamentation that clearly distinguishes Chilean plants. A key is provided to distinguish six species in Chile, with a morphological description and SEM images for the new combination.

Key words: Chile, *Piptochaetium*, Poaceae, Stipeae.

Piptochaetium J. Presl is an American genus of 36 species placed in the grass tribe Stipeae (Cialdella, 2003). The geographical distribution of the genus is from southern Chile and Argentina, north to the United States (Cialdella & Arriaga, 1998; Cialdella & Giussani, 2002). *Piptochaetium* is found in temperate, cold-temperate, and warm regions of both hemispheres, but is absent or poorly represented in the tropics (Nicora & Rúgolo de Agrasar, 1987). *Piptochaetium* is more diverse in South America with 27 species. The most recent treatments that include Chilean species are Parodi (1944) and Cialdella and Arriaga (1998), both recognizing seven species.

Piptochaetium is a perennial, caespitose grass, with membranaceous ligules. The inflorescence is a panicle generally contracted (lax in *P. bicolor* (Vahl) E. Desvaux), few or multi-spiculate, with short branches. The spikelets are 1-flowered, compressed laterally, and disarticulating above the glumes. Glumes are usually longer than the lemma, membranaceous, awned, and 3- to 7-nerved. The lemma is coriaceous, striate, not convolute, longitudinally grooved, glabrous, with papillae, prickles, or hooks, the margins inrolled and tucked into the palea groove, with a crown, generally with papillae, prickles, or microhairs, and is exceeded by the palea. The awn is 1- or 2-geniculate, persistent or caducous, delicate, with a twisted column, hispidulous at the base and rough at the apex. The callus is acute and sharp, or obtuse and obliquely truncate, and more or less pubescent.

Piptochaetium resembles *Jarava* Ruiz & Pavón and *Nassella* (Trinius) E. Desvaux, but is readily distinguished by the combination of a few morphological characters. In *Piptochaetium*, the margins of the lemma clasp the sulcus of the palea, and the summit is sometimes expanded into a paleal crown. In *Jarava* and *Nassella*, the lemma is convolute and encloses the palea. In *Piptochaetium*, the palea is coriaceous, grooved, 2-keeled, and with the apical mucro projecting from the lemma apex. In contrast, the palea in *Jarava* and *Nassella* is hyaline, not grooved, shorter than the lemma, and with two or no nerves.

According to the infrageneric classification, *Piptochaetium* is divided into two sections (Parodi, 1944), both with species in Chile. The sections principally differ in the callus shape and awn persistence. The section *Piptochaetium* is characterized by an obtuse callus and caducous awn, and comprises five species. *Piptochaetium* sect. *Podopogon* (Rafinesque) Parodi is characterized by an acute callus and persistent awn, with one species, *P. bicolor* in Chile.

Toward a better understanding of the morphological variation in the genus *Piptochaetium*, 362 specimens from the CONC and SGO herbaria were analyzed, including type material. Additionally, material of *P. montevidense* (Sprengler) Parodi from Argentina (SI: *Cialdella 16*, *Renvoize 4336*, *Tovar 9322*, *Múlgura 1498*, *Burkart 13431*, *Dusén 2381*, *Barros 3940*) and Brazil (COL: *Grazrotin 3624*) was analyzed. One specimen from each province was chosen. SEM imaging was used to evaluate the micromorphological characters; one anthoecium from herbarium material for each species was removed. Ellis' terminology was used for the epidermal appendages of the lemma (Ellis, 1979). A complete description of the new combination is given here; for the remaining species descriptions see Cialdella and Arriaga (1998). An identification key was then constructed.

In the present work, six taxa of *Piptochaetium* are recognized in Chile: *P. angolense* Philippi, *P. bicolor*, *P. depressum* (Steudel) C. Peña, *P. panicoides* (Lamarck) E. Desvaux, *P. setosum* (Trinius) Arechavaleta, and *P. stipoides* (Trinius & Ruprecht) Hackel ex Arechavaleta var. *stipoides*. The species are distributed in Chile from Región de Coquimbo (29°54′S) to Región de Los Ríos (40°36′S), concentrated on the coast and in the central valley, at altitudes up to 1800 m.

Piptochaetium depressum (Steudel) C. Peña, comb. nov. Basionym: *Urachne depressa* Steudel, Syn. Pl. Glumac. 1: 123. 1854. TYPE: Chile. Rancagua,

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May 1828, *C. G. Bertero 456* (holotype, P; isotype, MPU not seen).

Piptochaetium verrucosum Philippi, Linnaea 33(3–4): 280. 1864. TYPE: Chile. [Los Ríos:] Valdivia, San Juan, s.d., *R. A. Philippi s.n.* (holotype, SGO 57334; isotypes, SGO 57350 not seen, US 1108653 fragm. ex SGO, US 823178 fragm. ex SGO, US fragm. ex SGO PHIL 36).

Piptochaetium humile Philippi, Anales Univ. Chile 93: 730. 1896. TYPE: Chile. [Valparaiso:] Concón, médanos, 12 Oct. 1884, *F. Philippi s.n.* (holotype, SGO 45087; isotypes, US, photo SGO 45087, US fragm. ex SGO PHIL 46).

Piptochaetium granulatum Philippi, Anales Univ. Chile 93: 732. 1896. TYPE: Chile. [Valparaiso:] Concón, Oct. 1884, *F. Philippi s.n.* (holotype, SGO 57333; isotypes, US 1819509 fragm. ex SGO, US fragm. ex SGO PHIL 51, US photo SGO 57333).

Piptochaetium moelleri Philippi, Anales Univ. Chile 93: 734. 1896. TYPE: Chile. [Araucania:] Renaico, Nov. 1887, *P. Möller s.n.* (holotype, SGO 57332).

Culms 16–60 cm high, 0.4–0.5 mm diam., with 2 or 3 nodes, compressed, glabrous; internodes 4.5–14 cm. Sheaths 3.9–5.8 cm, margin membranous or hyaline; ligules truncate or obtuse, 1–1.8 mm, glabrous; blades narrow and convolute, 4.8–10.5 cm × 0.4–0.6 mm. Panicles 4–4.7 × 3.9–7 cm, with 25 to 35 spikelets, branches contracted. Spikelets 3–4 × 1.1–1.5 mm; glumes glabrous, central zone violaceous to the base, lower glume 2.5–4.1 mm, 5-nerved; upper glume 2.1–4 mm, 3-nerved; lemmas obovoid, 1.9–2.5 × 1–1.6 mm, contracted below the crown, longitudinally grooved, glabrous, with recurved hooks at the very top and distributed densely and uniformly over the lemma surface, sparser below and almost absent toward the callus; crown 0.4–0.5 mm diam., margins with hooks and prickles; callus obtuse, 0.2–0.3 mm, pubescent, hairs no longer than 1/4 of lemma; awn geniculate or bigeniculate, caducous, 0.8–1.5 cm; palea 1.6–2.2 mm; lodicules 2, 0.5–0.6 mm; stamens 0.5–0.7 mm; ovary 0.4–0.7 mm. Caryopsis 1–1.5 mm.

Distribution. *Piptochaetium depressum* is distributed in Chile from the Región de Coquimbo to Región de Los Ríos (31°35′–40°36′S), growing from near sea level to about 1500 m, preferentially concentrated in the coastal zone and central valley, but poorly represented in the Andes.

Relationships. *Piptochaetium depressum* is characterized by the obovoid lemmas, with hooks distributed over the entire surface, becoming less dense toward the crown, almost absent above the callus (Fig. 1A, B). *Piptochaetium depressum* is similar to *P. montevidense* and can share some features with *P. angolense*. In fact, the specimens of *P. depressum* have been previously identified as *P. montevidense*, but can be easily distinguished from this species because *P. montevidense* presents the lemma always gibbous, with papillae almost absent under the crown and diminishing above the callus (Fig. 1C, D). With this nomenclatural change, *P. montevidense* is absent in Chile. *Piptochaetium depressum* differs from *P. angolense* by the distribution and type of hooks on the lemma. In *P. angolense* these are found in the upper 3/4 of the lemma surface (Fig. 1E, F), and in *P. depressum* hooks are distributed over the entire surface from the apex to callus. In addition, these two species share a sympatric geographic distribution.

Representative specimens examined. CHILE. **Región del Biobío**: Prov. Ñuble, Cobquecura, Fundo La Reforma, Nov. 1958, *Matthei s.n.* (CONC); Prov. Concepción, Talcahuano, Rocoto, *Villarroel y Weldt 104 A* (CONC); Prov. Biobío, Laja, Hacienda Las Canteras entre Antuco y Los Angeles, *C. Muñoz* y *G. T. Johnson 2738* (SGO). **Región de Coquimbo**: Prov. Choapa, Huentelauquén, *Jiles 2808* (CONC). **Región de La Araucanía**: Prov. Malleco, Mininco, *Montero 8808* (CONC). **Región del Libertador General Bernardo O'Higgins**: Prov. Cardenal Caro, 19 km E de Pichilemu, 2.6 km O de Puente Los Valles, *Lammers et al. 7887* (SGO); Prov. Cachapoal, Palmeria de Cocalán, *C. Muñoz, Bartlett y Zudzuki 3516* (SGO). **Región de Los Ríos**: Prov. Valdivia, San José de la Mariquina, *Klempau 416 y 452* (CONC). **Región del Maule**: Prov. Talca, Pumunquén, *D. Contreras y F. Oyanedel 494* (SGO); Prov. Linares, Reserva Nac. Los Bellotos del Melado, *Arroyo et al. 994895* (CONC); Prov. Cauquenes, Cauquenes, Nov. 1960, *Ruiz s.n.* (CONC). **Región Metropolitana**: Prov. Santiago, Cuesta La Dormida, Nov. 1950, *Behn K. s.n.* (CONC); Prov. Cordillera, Reserva Nac. Río Clarillo, *Araya 46* (CONC); Prov. Maipo, Cajón del Maipo frente desembocadura El Manzano, *M. Muñoz et al. 3409* (SGO). **Región de Valparaíso**: Prov. Petorca, Huaquen, *Koehler 218* (CONC); Prov. Quillota, Los Maitenes, cerro de La Comunidad, *Garaventa 5204* (CONC); Prov. Valparaíso, Ritoque, 2 km SO de Quintero, *Serey 3* (CONC); Prov. San Antonio, Llolleo, Fundo Las Brizas, *San Martín M. 344* (SGO).

Key to *Piptochaetium* in Chile

1a. Callus acute with macrohairs longer than 1/2 length of lemma; awns persistent, bigeniculate; crown with macrohairs 0.4–0.5 mm. . . . . *P. bicolor* sect. *Podopogon*

1b. Callus obtuse with macrohairs no longer than 1/2 length of lemma; awns caducous, geniculate or bigeniculate; crown with hooks or prickles to 0.3 mm, but without macrohairs. . . . . *Piptochaetium* sect. *Piptochaetium*

Key to Species of *Piptochaetium* Sect. *Piptochaetium* in Chile

1a. Lemma obconical; callus densely pubescent with macrohairs to 1/2 length of lemma; crown revolute with more than 5 rows of prickles on margin. . . . *P. stipoides*

1b. Lemma elliptic to conspicuously gibbous; callus pubescent with hairs no longer than 1/3 length of lemma; crown not revolute, with 1 to 3 rows of prickles or hooks 2

2a. Lemma conspicuously gibbous, with maximum width in the middle, glabrous, with papillae below the crown, rarely with hooks on the

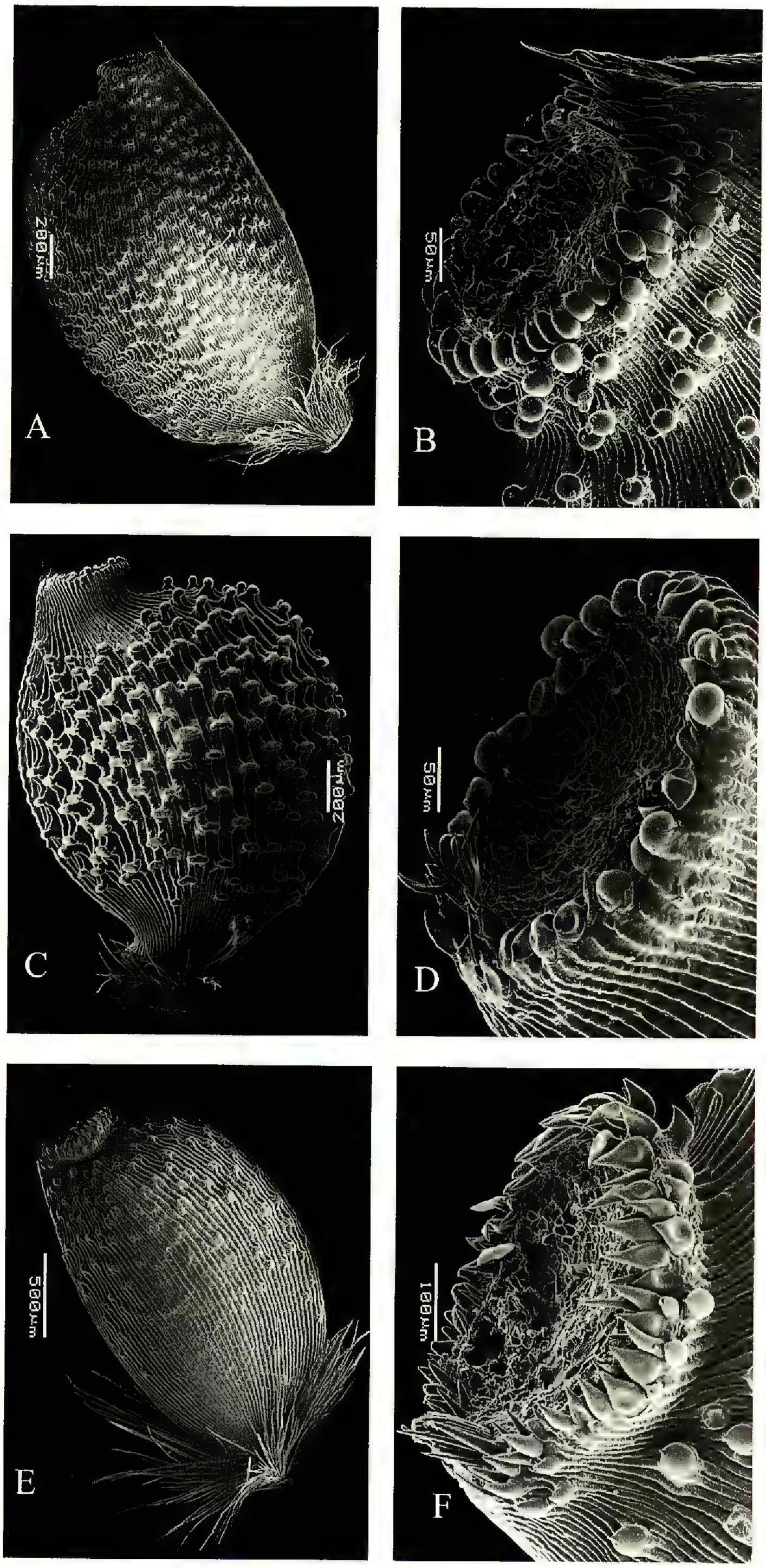

Figure 1. A, B. *Piptochaetium depressum* (Steudel) C. Peña (*Montero 8808*, CONC). —A. Anthoecium. —B. Crown. C, D. *Piptochaetium montevidense* (Sprengler) Parodi (*Cialdella 16*, SI). —C. Anthoecium. —D. Crown. E, F. *Piptochaetium angolense* Philippi (*Marticorena & Rodríguez 1722*, CONC). —E. Anthoecium. —F. Crown.

dorsal side; crowns with tiny hooks . . . . . *P. panicoides*

2b. Lemma elliptic to gibbous, with maximum width just below the crown, generally with hooks; crowns with conspicuous prickles or hooks 3

3a. Hooks densely and uniformly distributed on lemma surface, fewer toward the crown and absent toward the callus . . . *P. depressum*

3b. Hooks on the distal 3/4 of the lemma or fewer below the crown 4

4a. Hooks densely and uniformly distributed on the distal 3/4 length of the lemma; crown with 2 to 3 rows of prickles; callus hairs less than 1/3 length of lemma . . . . . *P. angolense*

4b. Hooks only a few below the crown; lemma glabrous; crown with one row of prickles; callus hairs more than 1/3 length of lemma. . . . . *P. setosum*

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A New Rare Species of *Lobelia* (Campanulaceae, Lobelioideae) from Mexican Lowland Rainforest

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ABSTRACT. *Lobelia lithophila* Senterre & Castillo-Campos (Campanulaceae, Lobelioideae) is described as a new species from the lowland tropical evergreen rainforest of the region of Uxpanapa, in southern Veracruz, Mexico. This species is only known from the type locality and probably represents a microendemic. The species described is most closely related to *L. orientalis* Rzedowski & Calderón, another local endemic from Querétaro, Mexico. Both taxa combine the herbaceous life form with leaves more or less in a rosette at ground level and a completely superior ovary, and are from specialized habitats. The new species is easily distinguished by its longer leaf blade and smaller petiole, and by its reduced leaf pubescence. Its habitat is also unusual, as it is restricted to limestone rocks in the understory of lowland tropical rainforest. *Lobelia lithophila* belongs to subsection *Leiospermae* E. Wimmer within the section *Lobelia*, subgenus *Lobelia* L.

RESUMEN. Se describe como nueva especie para la ciencia a *Lobelia lithophila* Senterre & Castillo-Campos. Esta es una especie conocida solamente de la localidad tipo y probablemente corresponde a un taxa microendémico para la selva alta perennifolia de la zona de Uxpanapa al sur de Veracruz, México. La especie aquí descrita esta más relacionada con *L. orientalis* Rzedowski & Calderón, otro microendémico en este caso de Querétaro, las cuales se destacan por ser especies herbáceas con hojas arrosetadas en el suelo con ovario totalmente súpero y que también son de hábitats muy restringidos. Es fácil distinguir a la especie nueva por sus hojas grandes pero de pecíolos pequeños, y por su pubescencia menos desarrollada. Asimismo, es una especie que se localiza en un hábitat especial, en sustratos rocosos calizos de bajas altitudes, en el sotobosque de la selva alta perennifolia. Esta especie pertenece a la subsección *Leiospermae* E. Wimmer, sección *Lobelia* del subgénero *Lobelia* L.

Key words: Campanulaceae, *Diastatea*, IUCN Red List, *Lobelia*, Lobelioideae, Mexico, subsection *Leiospermae*, Veracruz.

The Lobelioideae, which are best understood at the subfamily level (Lammers, 1992, 1998, 2007; APG II, 2003), are characterized by the gathering of the stamens around the style, the connate anthers forming a definite tube, and the presence of articulated lactifers. Within the subfamily, the genus *Lobelia* L. is the largest, with probably more than 400 species (Lammers, 2004a, b). It is easily recognized by its bilabiate corolla, which is cleft dorsally. This genus is almost cosmopolitan but is most diverse in the tropics and subtropics (commonly at higher elevations). About 29% of the species are from North America and more than 30 species (8%) are from South America, including many local endemics (Lammers, 2004b). Mexico is a center of diversity for this genus, with more than 40 species (McVaugh, 1940; Ayers, 1987; Wilbur, 1991; Turner, 1995; Rzedowski & Calderón, 1997, 2001; Lammers, 2004b). In the most recent monograph (Wimmer, 1943, 1953, 1968), the genus *Lobelia* was subdivided into three subgenera, and the sections have recently been recircumscribed by Murata (1995) with further comments by Lammers (1993, 2000, 2004b, 2007).

While studying the Campanulaceae for the Flora of Veracruz, many specimens were examined from the relevant national and international herbaria for the flora of Mexico. Some of the specimens examined did not match any previously described species within the family and are described here as a new species. This

species combines some rare features, such as the small semi-rosette herbaceous habit and the completely superior ovary, as well as its wide leaves and strongly reflexed calyx lobes. The superior position of the ovary is a rare character, even in the family, and is observed mainly in a small group of southern and central Mexican species of *Lobelia*. Moreover, the new species is found in a very specialized habitat, growing on limestone rocks in the understory of wet lowland rainforest. This lithicolous growth form is also characteristic of the species that is most closely related to the new species, *L. orientalis* Rzedowski & Caldéron, which is a narrow endemic found in the extreme northeast of Querétaro, Mexico, at 2000 m. Owing to its ellipsoid-ovoid, tuberculate-striate seeds and its small white to dark blue flowers, *L. lithophila* belongs to the subsection *Leiospermae* E. Wimmer, in the section *Lobelia* L. (previously section *Hemipogon* Bentham) and the subgenus *Lobelia* L.

Lobelia lithophila Senterre & Castillo-Campos, sp. nov. TYPE: Mexico. Veracruz: Hidalgotitlán, camp. Hermanos Cedillo, camino a La Escuadra, Río Solosuchil, 17°16′N, 94°37′W, selva alta perennifolia, primaria, suelo arcilloso, rocoso, 150 m, 9 Nov. 1974 (fl., fr.), *M. Vázquez T. 1367* (holotype, ENCB; isotypes, ENCB, XAL). Figure 1.

Herba verisimiliter perennis, semirosulata, caule strigoso tortuoso 3–5 cm alto, internodiis 2–5 mm longis, radicibus fasciculatis; *Lobeliae orientali* Rzedowski & Calderón affinis sed differt lamina foliari longiore plus minusve elliptica 3.5–6 cm longa et petiolo breviore, ad 25 mm, nervis lateralibus 4 ad 7 paribus adscendentibus, plus minusve bifurcatis ca. 5 mm ante marginem vel aliquando prope nervum centralem ramosis; pedicellis (1.2–)1.5(–2.2) cm longis, adscendentibus et plus minusve glabratis; hypanthio plano subnullo dense hirsuto; calycis lobis reflexis anguste triangularibus 2.5–3.5 mm longis; capsula late ovoidea 3–4 mm longa, omnino superiore; seminibus ca. 0.5 mm longis brunneis longistrorsum striatis et tuberculatis.

Herb, probably perennial, locally abundant, ca. 10–12 cm high, internodes ca. 2–5 mm, semi-rosette hemicryptophyte; shoot unbranched, but individuals generally closely clustered and joined underground by rhizomatous ramifications; shoot shortly raised to 2–3(–5) cm height, slightly tortuous or zigzag, deeply fluted, regularly covered with hirsute to setose, white, triangular, flat, multiseptate, uniseriate hairs; roots fasciculate at the base of the shoot, all < 0.2 mm diam.; leaves exstipulate, alternate, simple, on the top of the shoot when this is developed, but mostly appearing as a basal semi-rosette; smaller leaves sometimes present at the base of the semi-rosette; normal leaves mostly microphyllous (< 20 cm^2), blade 3.5–6 × 1.5–3 cm, mostly elliptic but also some oblong to lanceolate, smaller leaves to 1.5 × 0.9 cm; petiole ca. 1/2 the blade length, 15–25 mm; blades on dried specimens yellowish green to olive adaxially pale green abaxially, the secondary nerves and their main bifurcations typically discolored yellowish white, at least at the enlarged base of the central nerve; blade papyraceous, plane; venation plane adaxially, raised abaxially mainly for the central nerve, which is enlarged near the base and marked with longitudinal lines; blade pubescence similar to shoot extending along petiole and abaxially on central and secondary nerves, less abundant to nearly absent on the blade and adaxially; blade margin ciliate with the same hirsute-setose white long hairs, very slightly revolute (10×), and marked with very thin teeth derived from the end of the secondary nerves and their main prolongations (2 teeth/cm); blade apex progressively acute, most often rounded, sometimes acute to subacuminate and then acumen as long as wide, rounded, < 5 mm; leaf base generally slightly more rounded than apex, some leaves appearing nearly ovate, clearly decurrent on the petiole for ca. 3–6 mm; venation pinnate, with 4 to 7 pairs of secondary nerves ascending and forming an acute angle with central nerve; secondary nerves typically ramified, generally bifurcated ca. 5 mm from the margin, sometimes ramifications starting near the central nerve and appearing fasciculate; wide network of tertiary nerves only slightly visible abaxially. Inflorescence a loose terminal raceme, probably polytelic with 12 to 19 flowers, sometimes with a pair of small leafy bracts at the base but well differentiated from the shoot, ca. (12–)15(–22) cm, including 4–6 cm peduncle, with long white hirsute hairs progressively less abundant distally to the subglabrous pedicels; inflorescence axis slightly compressed, longitudinally striate; pedicel bracts persistent, narrowly acute, 2–2.8 × ca. 0.5 mm at base, apex mucronulate, sometimes concave and the margin slightly revolute adaxially, pale green at the base and generally purple on the distal part or the margin; pedicel minutely bibracteolate at base, (1.2–)1.5(–2.2) cm, ca. 0.2 mm diam., glabrous or sparsely hirsutulous but never scabrous or puberulent, arcuate-ascending, becoming strongly recurved distally in fruit so that the capsules are facing the ground. Flowers bisexual, tetracyclic, pentamerous, zygomorphous, white to dark blue, ca. (7–)9–11 mm, including hypanthium; gamosepalous calyx of 5 sepals prolonged downward by a wide flattened hypanthium typically covered with long white hirsute hairs; calyx lobes narrowly acute, 2.5–3.5 mm, becoming reflexed and generally perpendicular to the flower's pedicel or rarely divergent in some developing flowers, pale green, glabrous, central nerve raised abaxially, margins slightly recurved

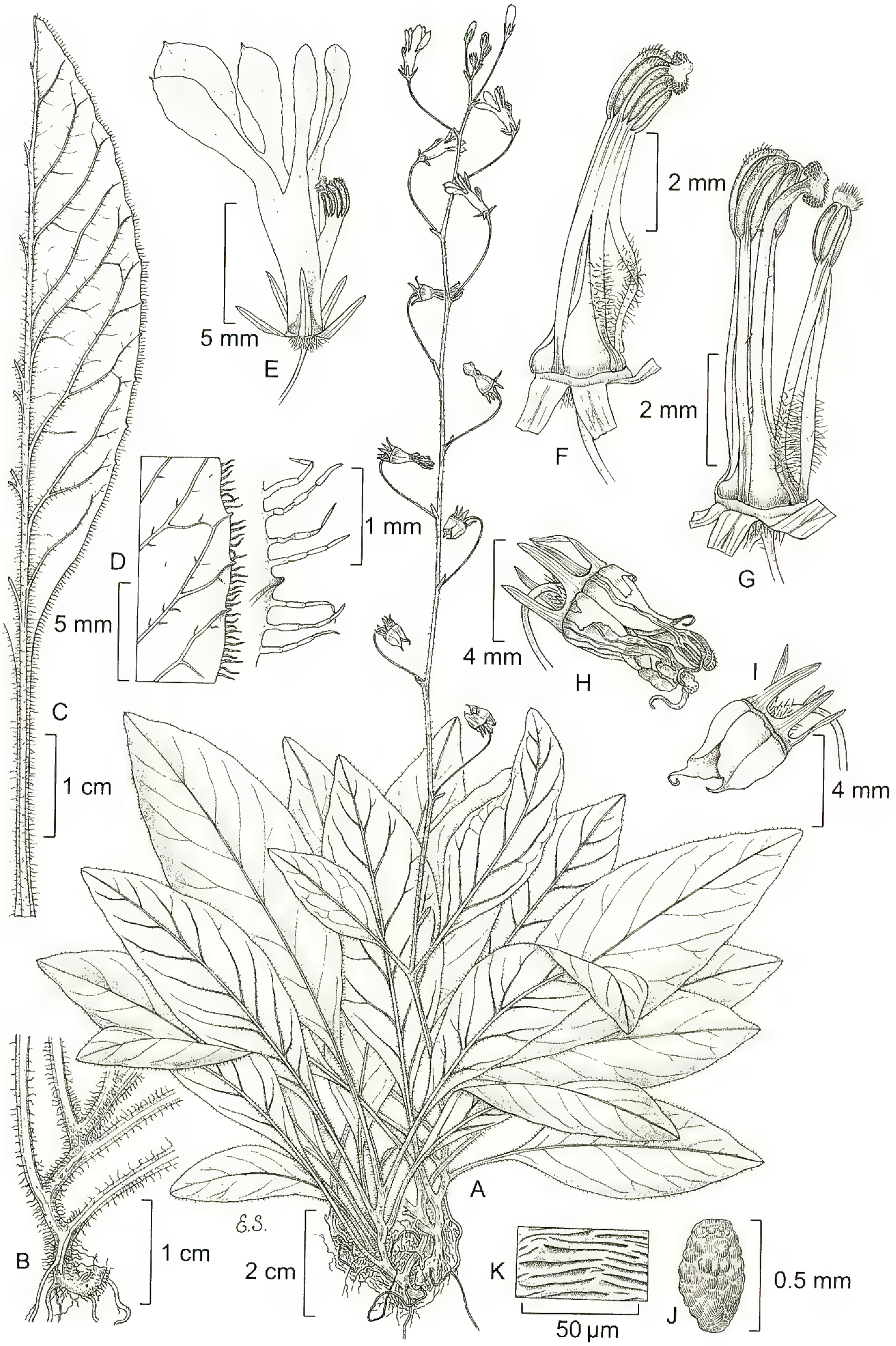

Figure 1. *Lobelia lithophila* Senterre & Castillo-Campos. —A. Habit. —B. Stem base. —C. Leaf venation and pubescence (abaxial face). —D. Details of the leaf margin. —E. Flower. —F, G. Details of the androecium and gynoecium. —H, I. Mature capsule. —J. Seed. —K. Detail of the seed surface. Drawn from the holotype *M. Vásquez T. 1367* (ENCB).

adaxially and purple-blue punctate; corolla gamopetalous, zygomorphic, bilabiate, cleft dorsally to its base or < 1.5 mm from base (since flowers of Lobelioideae are resupinate at anthesis, i.e., rotated 180° via torsion of the pedicel, the dorsal face corresponds to the visually ventral one), not fenestrate; 2 dorsal lobes relatively narrow though sometimes enlarged distally, ascending right in the floral axis; 3 ventral lobes more

typically spatulate with the apex rounded to short acuminate, forming a small angle with the tube; corolla white to dark blue, especially on the lobes; lower lip of medium lobe to (3.3–)5–5.5 mm, the lateral lobes shorter, mostly 3.3 mm; the 2 dorsal lobes ca. 5 mm; corolla tube slightly enlarged distally, generally just shorter than lobes, ca. 4.2–4.5 mm, or rarely slightly longer than the lower lip, ca. 2 mm diam. at top, glabrous; androecium pentamerous, antisepalous, the 5 filaments connate distally 1/3 or less their total length, forming a tube around the style; filaments white, ca. 4.5 mm, their free section densely pilose on the external face of the two ventral ones, filament free sections winged, ca. 0.3 mm wide, slightly narrower near base; androecium inclined dorsally through the cleft in the corolla; anthers tetrasporangiate, dithecal, basifixed, connate, forming a black tube ca. 1.2 × 0.7 mm diam., dehiscent introrsely via longitudinal slits; flowers proterandrous, with an introrse discharge of pollen onto stylar structures preceding the elongation of the style and maturation of the stigma (secondary pollen presentation); the two ventral anthers (appearing dorsal because of the resupinate flowers) shorter than the other three so that the anthers' tube is curved ventrally; 3 dorsal anthers glabrous or with sparse long white hairs; 2 ventral smaller anthers nearly glabrous but white-tufted at tip; ovary gamocarpous, never more than 1/3 inferior, 2-carpellate; 2-locular; flattened at the base and then conical, quickly becoming wide and ovate, as wide as long, 0.5–2 mm in the developing flower; placentation axile; ovules anatropous, numerous; style unique, rubanate, ca. 4.5 × 0.3 mm; dense pubescence of short stout stylar hairs for the secondary pollen presentation observed on the lateral parts of the minutely 2-lobed stigma, lobes rounded, ca. 0.15 mm (observed on developing fruits). Fruit a loculicidal capsule, appearing completely superior at maturity, shape similar to the floral ovary, the base truncate on the flat hypanthium, 3–4 mm, as long as wide, glabrous; apex with 2 acute lobes corresponding to the opening of the upper part of carpels, remainder of the style ± short; pedicel as long as in mature flowers, 1.5(–2.2) cm; calyx persistent, completely reflexed and parallel to the floral axis; corolla and androecium also persistent, ± dry and wrinkled at the base of the capsule; seeds numerous, ca. 30 per locule, brown to dark brown, elliptic-oblong in longitudinal section, elliptic in cross section, ca. 0.5 × 0.24 mm, rounded at apex, obliquely subtruncate at base, the surface (40×) longitudinally striate, punctate.

Distribution and habitat. *Lobelia lithophila* is probably a very narrow endemic from the south of the state of Veracruz, Mexico. It is only known from the type locality, with three collections from 1974 all by the same collector. It was collected in old growth lowland tropical rainforest (selva alta perennifolia), on very superficial soil, with limestone rocks on the surface, and grows on rocky steep slopes. This forest type is characterized in the tree layer by the following species: *Bernoullia flammea* Oliver, *Brosimum alicastrum* Swartz, *Dialium guianense* (Aublet) Sandwith, *Ficus lapathifolia* (Liebmann) Miquel, *Lonchocarpus guatemalensis* Bentham, *Pleuranthodendron lindenii* (Turczaninow) Sleumer, and *Simira salvadorensis* (Standley) Steyermark (Vásquez, 1991). The shrub layer is dominated by *Ardisia wendtii* (Lundell) Pipoly & Ricketson, *Bunchosia lindeniana* A. Jussieu, *Crossopetalum densiflorum* Lundell, *Ouratea pyramidalis* L. Riley, *Piper amalago* L., *P. hispidum* Swartz, and *Psychotria veracruzensis* Lorence & Dwyer.

IUCN Red List category. *Lobelia lithophila* has been seen only three times, in the same locality and habitat. We therefore have no idea of its population extent. Nevertheless, we know that its habitat and distribution are probably limited to the type locality. Because the forests of this region have been much reduced, *L. lithophila* should probably be considered a threatened species, most likely, Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001). On an expedition to the type locality in January 2007, we did not find any individuals of this species, but we do not think that it could be extinct.

Etymology. The epithet *lithophila* refers to the specialized habitat of the described species, which seems to be restricted to limestone rocks on very superficial soil, in the understory of tropical rainforest. It is derived from the Greek "lithos" (stone) and "philos" (loving).

Relationships. *Lobelia lithophila*, owing to its completely superior ovary, is related to some taxa from central and southern Mexico. It is clearly distinguishable from all other *Lobelia* because of the unique combination of the superior ovary with the semi-rosette herbaceous habit, the wide elliptic leaves, and the calyx lobes completely reflexed in fruit.

As mentioned by Rzedowski and Calderón (1997), the tendency to reduction of the hypanthium resulting in the nearly superior ovary seems to have occurred several times within the subsection *Leiospermae* of *Lobelia*, and is mainly represented by narrow endemic species from south and central Mexico. This trend is noticeable in a group of narrow-leaved *Lobelia* including *L. dielsiana* E. Wimmer, *L. hintoniorum* B. L. Turner, *L. occidentalis* McVaugh & Huft, and *L. sublibera* S. Watson. Another group with a superior

Table 1. Main diagnostic features distinguishing species of *Lobelia* with superior ovary and rosette to semi-rosette herbaceous habit.

	L. lithophila	*L. orientalis*	*L. pulchella*
Habit	semi-rosette	rosette	rosette
Shoot pubescence	hirsute-setose	white hoary	hirtellous
Shoot ramification	none	at base	none
Blade length (cm)	5	2	5
Blade shape	elliptic	ovate	obovate
Petiole (mm)	20	40	5
Margin teeth	entire with some callosities	entire with some callosities	large obtuse teeth
Pedicel pubescence	sparsely setose	hirsutulous	glabrescent
Hypanthium shape	discoid	discoid	conical
Hypanthium pubescence	hirsutulous	glabrous	not observed
Calyx lobe orientation	reflexed	ascending	ascending
Ovary position	superior	superior	< 1/3 inferior
Seed surface	striate-tuberculate	foveolate-reticulate	smooth
Distribution	SE Veracruz	NE Querétaro, near San Luis Potosí	from Oaxaca to Guerrero
Vegetation type	tropical lowland evergreen rainforest, on limestone rock, 150 m	*Cupressus–Pinus* upper montane forest, on limestone rock, 2000 m	oak and pine forest, rocky slopes, 2300 m

ovary is based on plants with wide leaves and a tendency to a prostrate semi-rosette habit, in which *L. lithophila* has to be placed next to *L. orientalis* and *L. pulchella* Vatke (Table 1). One of the problematic species in Mexico, *L. sartorii* Vatke, is somewhat related to that group in the aspect of its leaves and its general habit, at least for some forms with mostly basal leaves, but it is clearly different owing to the position of the ovary, which is always approximately half inferior. There is a complex of species related to *L. sartorii* including *L. caeciliae* E. Wimmer, which may also have a nearly superior ovary and deflexed calyx lobes but never present a semi-rosette, and *L. tarsophora* Seaton ex Green, which is characterized by its strongly divaricate pedicels. A third group with a superior ovary is made up of plants with a weedy aspect such as *L. xalapensis* Kunth, *L. cliffortiana* L., *L. diastateoides* McVaugh, and *L. hypnodes* E. Wimmer ex McVaugh, and probably indicates some relationship with the genus *Diastatea* Scheidweiler, which also has a superior ovary but without the cleft corolla.

The seed surface is another important character in the subdivision of *Lobelia*. In the subsection *Leiospermae*, most species have seeds smooth to faintly striate longitudinally. Three *Leiospermae* species from central and southern Mexico have been reported as exceptions, having foveate-reticulate seeds (McVaugh, 1940; Rzedowski & Calderón, 1997), including *L. orientalis*. Nevertheless, these seeds are not as deeply foveate as those of the subsection *Lobelia*. The seeds of *L. lithophila* are intermediate between the foveate-reticulate seeds and the typical *Leiospermae* striate seeds, having a remarkable striate-tuberculate surface.

Paratypes. MEXICO. **Veracruz**: Hidalgotitlán, Río Solosuchil, SW of Hermanos Cedillo camp, 17°16′N, 94°37′W, 2 Apr. 1974 (fr.), *M. Vázquez T. 300* (XAL), 30 Mar. 1974 (fl., fr.), *M. Vázquez T. 236* (XAL).

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A New Name for *Wasabia koreana* (Brassicaceae) in South Korea

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ABSTRACT. A new name, *Cardamine pseudowasabi* H. Shin & Y. D. Kim (Brassicaceae), is proposed for *Wasabia koreana* Nakai because the transfer of the epithet to *Cardamine* L. would create a later homonym.

Key words: Brassicaceae, *Cardamine*, South Korea, *Wasabia*.

Wasabia koreana Nakai (Nakai, 1935) was originally described as a new species based on the specimen collected around Gwangreung, a famous royal tomb in South Korea. Because the genus *Wasabia* Matsumura is no longer accepted, Baik et al. (1986) transferred the species to *Eutrema* R. Brown and proposed a new name, *E. koreanum* (Nakai) K. Hammer. The plant depicted in the article, however, does not appear to be *W. koreana* but looks very similar to a vegetable species introduced from Japan, *W. japonica* (Miquel) Matsumura, implying that they referred to the wrong species. Since then, in some regional floras including the *Flora of China* (Zhou et al., 2001), *W. koreana* as well as *W. japonica* are treated as synonyms of *E. wasabi* (Siebold) Maximowicz. Recently, Al-Shehbaz and Warwick (2005) considered *E. wasabi* a synonym of *E. japonicum* (Miquel) Koidzumi since the combination made by Zhou et al. (2001) was based on the nomen nudum *Cochlearia wasabi* Siebold and is therefore illegitimate. Unfortunately, these changes for *W. koreana* were apparently conducted without referring to the type specimen.

In a taxonomic review of *Wasabia koreana*, we carefully examined the holotype deposited in TI (Fig. 1) and concluded that Nakai misidentified the species within *Wasabia*. The type specimen exhibits morphological characters typical of *Cardamine* L. such as the presence of a long and slender style as well as simple trichomes on the leaf margin (I. A. Al-Shehbaz, pers. comm.). In addition, the specimen has no mucronate callosities on the leaf margin, which are diagnostic features observed in *Eutrema* (Zhou et al., 2001). Its transfer to *Cardamine* is clearly needed. Because the name *C. koreana* Nakai (Nakai, 1952) is already taken, we propose a new name for this misplaced species.

Cardamine pseudowasabi H. Shin & Y. D. Kim, nom. nov. Replaced name: *Wasabia koreana* Nakai, J. Jap. Bot. 11: 150. 1935, non *Cardamine koreana* (Nakai) Nakai, Bull. Natl. Sci. Mus. Tokyo 31: 49. 1952. TYPE: Korea. Kyunggi [Gyeonggi]: Gwangreung, Apr. 1934, *R. K. Smith 13* (holotype, TI).

Cardamine pseudowasabi H. Shin & Y. D. Kim most resembles *C. yezoensis* Maximowicz, but clearly differs from the latter by having simple leaves (including the basal ones; see Fig. 1) and a densely pubescent stem and leaf margin. Moreover, *C. yezoensis* ranges from Hokkaido to Sakhalin (Bush, 1939; Ohwi, 1985), while the type locality of *C. pseudowasabi* is far more southern (37°N). It is known that *C. yezoensis* is variable in leaf shape and trichome density on the leaf and stem (Bush, 1939). The plants of *C. pseudowasabi* have not been documented from the Gwangreung area since the original gathering, so there is no collection except for the holotype. More collections and extended research including specimens that encompass the entire geographical range of *C. yezoensis* are needed to be certain that *C. pseudowasabi* is not an extreme form of *C. yezoensis*.

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Figure 1. Type specimen of *Cardamine pseudowasabi* H. Shin & Y. D. Kim (*Smith 13*, TI).

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A New Species of *Simira* (Rubiaceae, Simireae) from Rio de Janeiro, Brazil

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ABSTRACT. *Simira walteri* Silva Neto & Callado (Rubiaceae, Simireae) is described and illustrated. It grows in the Atlantic Forest region in the state of Rio de Janeiro, Brazil, to an altitude of 600 m. The new species resembles *S. viridiflora* (Allemão & Saldanha) Steyermark, which also occurs in the Atlantic Forest in southeastern Brazil. *Simira walteri* mainly differs in having elliptic leaves with apices acute to slightly acuminate, base acute, tufted pocket-domatia, and a single row of colleters on the internal stipule base.

RESUMO. *Simira walteri* Silva Neto & Callado (Rubiaceae, Simireae) é descrita e ilustrada. A espécie ocorre na Floresta Atlântica do estado do Rio de Janeiro, Brasil, até 600 m de altitude. A nova espécie assemelha-se a *S. viridiflora* (Allemão & Saldanha) Steyermark, que também ocorre na Floresta Atlântica de todo o sudeste do Brazil, da qual *S. walteri* difere, principalmente, por apresentar folhas elípticas, ápice agudo a levemente acuminado, base aguda, domácia em bolsa com pelos e uma única fileira de coléteres na base interna da estípula.

Key words: Brazil, IUCN Red List, Rio de Janeiro, Rubiaceae, *Simira*, Simireae.

Simira Aublet is a Neotropical genus comprising ca. 45 tree species, of which 16 occur in Brazil. The woody genus is easily recognized in the forest due to the characteristic red color that the wood acquires immediately after cutting. During the revision of the extra-Amazonian species of *Simira* from Brazil (Silva Neto, 2000), the following new species was recognized.

Simira walteri Silva Neto & Callado, sp. nov. TYPE: Brazil. Rio de Janeiro: Nova Iguaçu, Tinguá, Biological Reserve of Tinguá (22°28′–22°39′S & 43°13′–43°34′W), 28 Nov. 1997 (fl.), *S. J. Silva Neto 1127, C. H. Callado & W. da Silva* (holotype, RB; isotypes, HRJ, R, RBR). Figure 1.

Arbor alta, usque 25 m; folia elliptica glabra, apice acuto vel leviter acuminato, basi acuta, 5.1–11.4 × 1.3–3.3 cm; inflorescentiae thyrsoideae axillares, plerumque 9-florae, pedunculo 2.9–3.5 cm; capsula lignosa ovata, 4.7–6.7 × 2.9–3.8 cm, valvis bipartitis. *Simira viridiflorae* (Allemão & Saldanha) Steyermark affinis, sed praecipue foliis ellipticis, 5.1–11.4 × 21.3–3.3 cm, apice acuto vel leviter acuminato et basi acuta differt.

Trees to 25 m tall, cortex grayish white, but reddish white inside; cylindrical branches terete, brownish white, rarely reddish brown, glabrous, sparser lenticels. Leaves concentrated at apex of branchlets, elliptic, apex acute or slightly acuminate, base acute, membranaceous, glabrous, the younger reddish, the mature green, 5.1–11.4 × 1.3–3.3 cm; petioles slender, glabrous, 7–22 mm; secondary veins in 6 to 13 pairs, intersecondary veins reticulate, tufted pocket-domatia abaxially on the axils of the secondary veins; terminal stipules 7–21 mm, triangular or slightly subulate, narrowing toward apex, glabrous, with a single row of colleters at the internal stipule base. Inflorescence axillary, generally thyrsoid; ± 9-flowered; peduncles glabrous, 2.9–3.5 cm, 2-bracteate at peduncle apex; bracts membranaceous, persistent, 3–4 mm. Flowers pedicellate, pedicels 2–7 mm; hypanthia glabrous, 4–5 mm; calyx campanulate, internally and externally glabrous, ca. 3(–4) mm, lobes triangular, short, acute, 1–1.5 mm; corolla tubular, with a short, greenish white tube, 3–4 (–5) mm, split longitudinally once or twice, externally and internally glabrous, except at basal filament attachment; lobes imbricate, 3 inside and 1 outside, rounded, reflexed, 4–5.5 mm, ciliate, obtuse to rounded; stamens 4, exserted, 6–6.5 mm, filaments densely pilose at their base, anthers oblong, ca. 3 mm, yellowish green; ovary greenish white, 5–5.5 × 2–2.5 mm, style filiform, glabrous, 4–1.2 mm, stigma decurrent. Capsules ovate, woody, rugose, glabrous, 4.7–6.7 × 2.9–3.8 cm, 2-valved, valves splitting and bipartite, locule wall 2–3 mm thick; seeds numerous, flat, 3.3–4.9 × 1.5–1.7 cm, reddish brown, wings slender.

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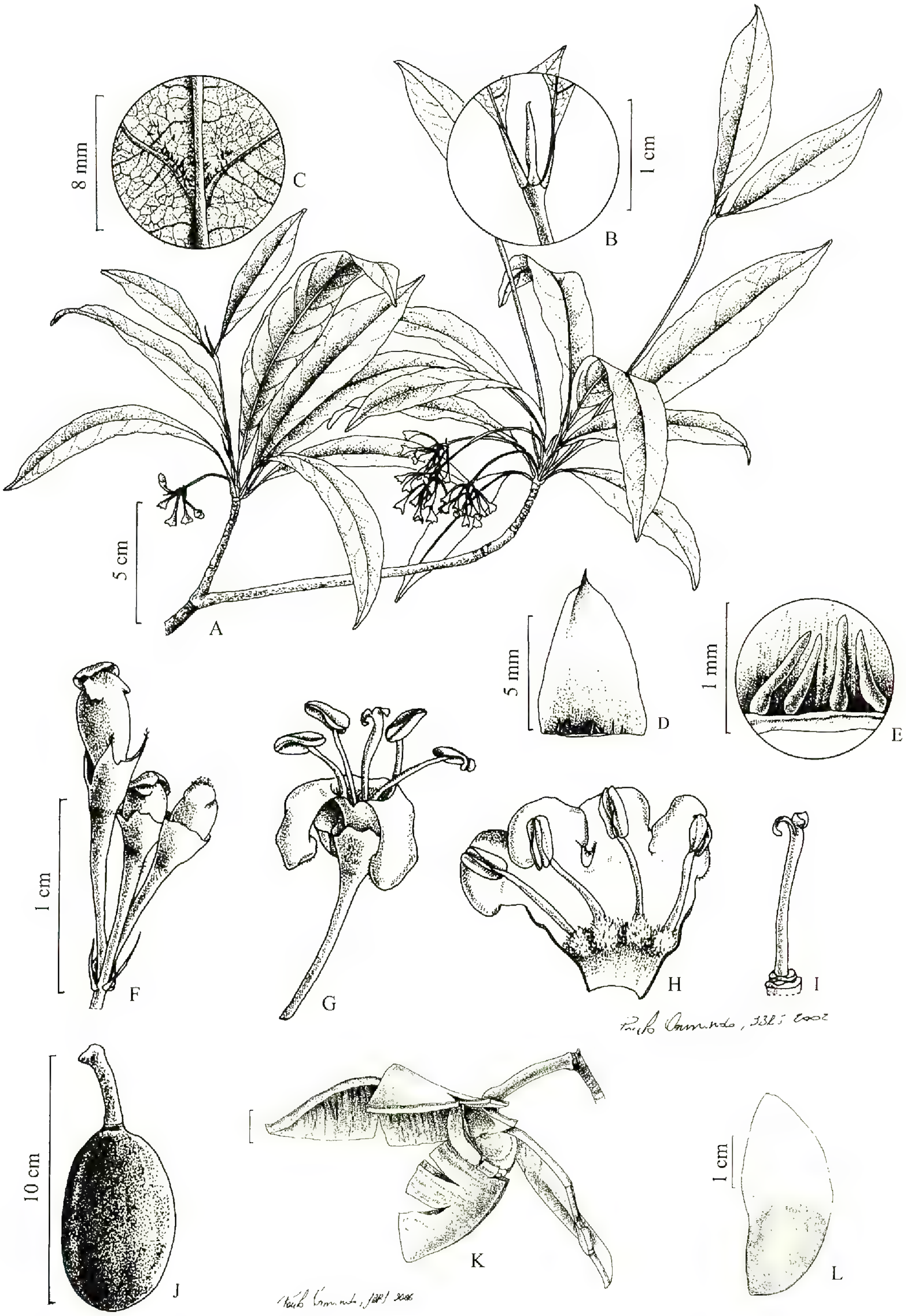

Figure 1. *Simira walteri* Silva Neto & Callado. —A. Habit. —B. Stipule. —C. Domatia. —D. Stipule with colleters. —E. Colleter detail. —F. Flower buds. —G. Flower. —H. Opened corolla. —I. Stigma. —J. Fruit. —K. Opened fruit. —L. Seed. A–J, L drawn from *Silva Neto 1127* (RB); K drawn from *Silva Neto 1673* (RB).

Distribution, habitat, phenology, and IUCN Red List category. *Simira walteri* occurs in the state of Rio de Janeiro in southeastern Brazil within the Atlantic Forest region, mainly in shady areas, at elevations to 600 m. It was collected in flower in September and in fruit in November. This species might be qualified as Vulnerable (VU) according to IUCN Red List criteria (IUCN, 2001) because of its restricted area of occupancy. It is an endemic species from Brazil, where a single population is known. It was discovered 10 years ago, and the population has been protected in the Biological Reserve of Tinguá. Apart from habitat destruction, no specific threats are known.

Etymology. The new species is named after Walter da Silva for his significant contribution to floristic surveys of the Atlantic Forest. He was born on 27 November 1942 in the Atlantic Forest region. He has been working hard to improve knowledge of this ecosystem, and his name has been cited in the acknowledgments of several scientific papers, books, and theses.

Relationships. *Simira walteri* is similar to *S. viridiflora*, which also occurs in the Atlantic Forest at the Biological Reserve of Tinguá (Silva Neto, 2000; Braz et al., 2004). The species can be distinguished by the leaves of *S. viridiflora* being oblong-lanceolate to spatulate, apex obtuse to acuminate, and the base attenuate or auriculate, with blades 17.5–42 × 6–11.5 cm, with tufted domatia, and several rows of colleters on the internal stipule base.

Paratypes. BRAZIL. **Rio de Janeiro**: Nova Iguaçu, Tinguá, Biological Reserve of Tinguá, Trilha do Deserto, 23 Feb. 2002 (fr.), *S. J. Silva Neto 1673, C. H. Callado & W. da Silva* (RB); Trilha do Deserto, lado direito da trilha no barranco, 23 Feb. 2002 (fr.), *S. J. Silva Neto 1678, C. H. Callado & W. da Silva* (RB).

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A New Shrub Species from a Dry Forest of Puerto Rico, *Reynosia vivesiana* (Rhamnaceae)

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Abstract. *Reynosia vivesiana* Trejo (Rhamnaceae) is a previously unrecognized species of woody shrub. It is known from a dry forest in southwestern Puerto Rico, where it has been recorded only in a small area in the Guánica Forest Reserve. The plant was treated for more than seven decades as *R. guama* Urban, a related species from the Virgin Islands. The new *R. vivesiana* is separated from *R. guama* and the other two species of *Reynosia* Grisebach from Puerto Rico by its glabrous twigs, petioles, and stipels, and by its smaller fruits (ca. 9 mm long), among other features. The segregation of *R. vivesiana* from *R. guama* heightens the importance of both species from a conservation standpoint. Based on IUCN Red List criteria, *R. vivesiana* can be defined as Critically Endangered (CR) and consequently needs legal protection.

Resumen. *Reynosia vivesiana* Trejo (Rhamnaceae) es una especie de arbusto leñoso previamente no catalogada. Es conocida en el bosque seco del suroeste de Puerto Rico, donde ha sido registrada en un área pequeña de la Reserva Forestal de Guánica. La planta fue tratada por más de siete décadas como *R. guama* Urban, una especie hermana de las Islas Vírgenes. La nueva *R. vivesiana* se distingue de *R. guama* y de las otras dos especies de *Reynosia* Grisebach de Puerto Rico por sus ramas jóvenes, peciolos y estipelas glabras, así como por sus frutos más pequeños de alrededor de 9 mm de largo, entre otras características. La segregación de *R. vivesiana* respecto de *R. guama* realza la importancia de ambas especies desde el punto de vista de su conservación. Con base en los criterios de la Lista Roja de la UICN *R. vivesiana* puede definirse como en peligro crítico y consecuentemente amerita protección legal.

Key words: Antilles, IUCN Red List, Puerto Rico, *Reynosia*, Rhamnaceae.

Reynosia vivesiana Trejo (Rhamnaceae) is a previously unrecognized species of shrub known only from a dry forest in southwestern Puerto Rico. From 1932–1990, it was collected at least 13 times in a small area in the Guánica Forest Reserve and identified as *R. guama* Urban, a species from the Virgin Islands. In fact, the drawing of *R. guama* in the book *Trees of Puerto Rico and the Virgin Islands* (Little et al., 1974) might actually be the new *R. vivesiana*. Unfortunately, the lack of a herbarium voucher reference on the drawing prevents the confirmation of this statement.

While studying rare plants of the region in several herbaria (BM, C, CICY, CIQR, F, FTG, GH, GOET, JBSD, K, L, MAPR, NY, P, SJ, UPR, UPRRP, US, W), I realized that specimens from Puerto Rico previously identified as *Reynosia guama* differed from those of the Virgin Islands. To study the live plants, I visited wild populations in Guánica (Puerto Rico), St. John (U.S. Virgin Islands), and Virgin Gorda (British Virgin Islands). *Reynosia vivesiana* and *R. guama* are clearly distinguishable by their plant architecture, bark, leaves, pubescence, fruits, seeds, and seedlings. The plant architecture of *R. vivesiana* is distinctive in its several elongated stems borne at the very base of the tree, arranged in a diffuse, obconic crown, while *R. guama* is a small tree or shrub with an ordinary dense crown. The bark of *R. vivesiana* is smooth and glaucous gray, while that of *R. guama* is vertically furrowed and brownish gray. The leaves of *R. vivesiana* are typically orbicular and obcordate, while those of *R. guama* are normally oblong and emarginate. In addition, the leaves of *R. vivesiana* typically dry pale brown and rigidly coriaceous, while those of *R. guama* normally dry pale gray and softly subcoriaceous. Fruits of *R. vivesiana* are about 9 mm long, while those of *R. guama* are up to 17 mm long. Seedlings of *R. vivesiana* and *R. guama* are distinct from one another, as evidenced by seeds in the wild and those germinated in a greenhouse. The seedlings of *R. vivesiana* are half the size and more delicate than those of *R. guama*. Leaf shape differences mentioned above are even more marked in seedlings and young plants.

In herbarium specimens, *Reynosia vivesiana* is similar in leaf appearance and fruit size to *R.*

domingensis Urban, endemic to the island of Hispaniola. Nevertheless, *R. domingensis* is puberulent and its leaves are oblong-elliptic and revolute, with the abaxial fine venation well contrasted. Based on flower morphology (Schirarend & Hoffmann, 1993), *R. vivesiana* seems to belong to a group that includes *R. domingensis*. However, this group is characterized by a tree-like habit, while *R. vivesiana* is a shrub.

Reynosia vivesiana Trejo, sp. nov. TYPE: Puerto Rico. Mun. Guánica: Barrio Carenero, Guánica Forest Reserve, Rd. 333, 0.5 km E of Copamarina entrance, N border of rd., 17°57′N, 66°52′W, 34 m, 17 Oct. 2004, *J. C. Trejo 2812* (holotype, UPR; isotypes, JBSD, K, MO). Figure 1.

Ab aliis speciebus portoricensibus *Reynosiae* Grisebach ramulis stipulisque glabris et fructibus parvioribus ca. 9 mm diametro differt; ab *R. guamae* Urban ramis elongatis pluribus in coronam conicam diffusam dispositis et cortice laevi glauco-cinerascenti differt.

Shrub to 6 m high; *crown* typically obconic, diffuse; *stems* multiple, elongate, to 5 cm diam., spreading, branching typically dichotomous; *foliage* restricted to terminal branches, perennial; *bark* on stems and twigs glabrous, glaucous gray. *Stipules* glabrous, broadly deltoid-squamiform, ca. 2 mm wide, composed of 2 lateral acutely triangular segments and 1 central subulate abaxial appendage; the lateral segments giving the appearance of paired intrapetiolar stipules when the abaxial appendage develops into a leaf; otherwise the appendage commonly caducous, leaving a 2-pointed stipule; *stipels* glabrous or scarcely puberulous, acutely triangular-pyramidal, ca. 1 mm, axillary. *Leaves* simple, opposite, decussate; *petioles* yellowish green, drying dark brown, slightly canaliculate above, glabrous, ca. 5 × 1.5 mm; *blades* orbicular to orbicular-oblong, to 5 cm, base round to subcordate, apex cordate to subcordate with a mucro ca. 1 mm pointing forward, rigidly coriaceous, green and somewhat shiny adaxially, paler abaxially, drying pale brown; *venation* pinnate, reticulate, finely translucent when fresh, pale when dry, minutely raised more evidently adaxially, central vein impressed adaxially, prominent abaxially. *Plants* monoecious. *Flowers* actinomorphic, perigynous, axillary, fasciculate; *pedicels* slender, ca. 8 × 1 mm, greenish red; *buds* rhomboid-globose from the sides, ca. 2 mm diam., apiculate, green tinted with red; *hypanthium* hemispherically cup-shaped, ca. 3 mm diam., lined with a yellowish green nectariferous disk; *sepals* 5, triangular, distally and adaxially keeled, ca. 2 mm, cream-colored adaxially; *petals* 5, ca. 1 mm, alternate to sepals, widely spatulate, base as wide as the filament base, apex obcordate, lobes truncate-erose and partially embracing the stamen, cream-colored; *stamens* 5, ca. 1.5 mm; *filaments* ca. 1 mm, reddish green; *anthers* ovate, ca. 1 mm, dark brown, dorsifixed, composed of 2 thecae that open longitudinally; *pollen* granulate, hyaline; *pistil* ca. 1.7 mm, green; *ovary* globose, ca. 1.2 mm diam., lustrous; *ovules* 2, angled, ca. 0.5 mm, white, basifixed; *style* cylindric, slightly widened and angular basally, dull; *stigma* of 2 joined red nipples. *Fruits* globose, ca. 9 mm, green, ripening purplish black, with a mucro ca. 1 mm; *stipe* ca. 5 × 1 mm; *receptacle*, shallowly cup-shaped; *seeds* globose to globose-obovate, ca. 7 mm, basifixed; *endocarp* woody-coriaceous, smooth, brown; *hilum* navel-like, protruded; *testa* loosely rugose; *endosperm* ruminate; *embryo* flat, central.

Distribution and IUCN Red List category. The segregation of *Reynosia vivesiana* from *R. guama* heightens the importance of both species from the conservation standpoint. *Reynosia guama* (at the time it included *R. vivesiana*) was categorized as endangered by Woodbury (1975), as rare by Little and Woodbury (1980), and as a critical element by the Departamento de Recursos Naturales y Ambientales de Puerto Rico (Quevedo et al., 1990). However, it was not included in the Center for Plant Conservation (1992) assessment. Its distributional range, now confined to the Virgin Islands, urgently requires a new protection category.

Meanwhile, the new *Reynosia vivesiana* is known from a single population composed of a few dozen individuals scattered in an area of a few square kilometers inside the Guánica Forest Reserve in Puerto Rico. Even assuming that its potential geographic range ("extent of occurrence" sensu IUCN, 2001) is the dry limestone forest in southern Puerto Rico, it covers only 83 km². Moreover, this zone, one of the most heavily impacted by human development in the island, is currently 30% forested and only 3.8% is under protection (Lugo et al., 2006). Consequently, following IUCN Red List criteria (IUCN, 2001), *R. vivesiana* is here proposed for legal protection as Critically Endangered (CR B1ab(i,ii,iii)+2ab(i,ii,iii)).

Habitat and phenology. *Reynosia vivesiana* occurs from sea level to elevations of 200 m. It is found in a dry coastal area with an average rainfall of 800 mm/yr.; the geological substrate is Tertiary limestone (Silander et al., 1986). Soil is scarce and stony. The area is covered by low forests or scrub in different successional stages after five decades of recovering from intense disturbance (Lugo et al., 1996). Vegetation contiguous to the sea is open scrub, with cacti common, while vegetation on gentle hills is a shrubby forest. *Reynosia vivesiana* has been found in groups of up to six individuals, including saplings. Its loose

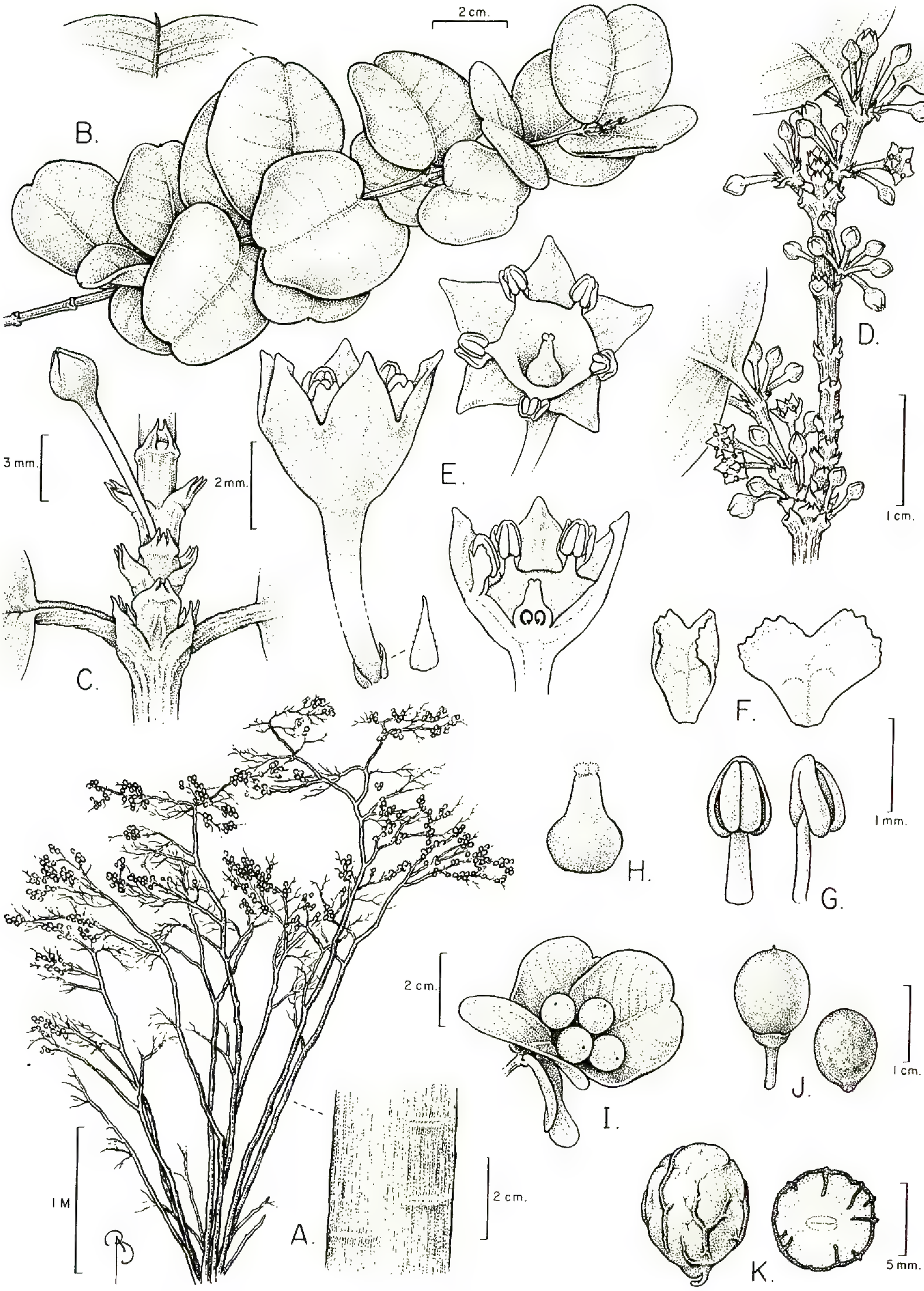

Figure 1. *Reynosia vivesiana* Trejo. —A. Habit, with detail of bark. —B. Twig with detail of mucro. —C. Fertile twig with details of stipules. —D. Fertile twig with clusters of buds and flowers. —E. Flower with lateral, face, and longitudinal section views, and detail of stipels. —F. Petals in normal incurved position (left) and flattened (right). —G. Stamens in adaxial (left) and subdorsal (right) views. —H. Pistil. —I. Fruiting branch. —J. Fruit (left) and stone (right). —K. Seed in lateral (left) and tranverse section (right) views. A, C–H from the holotype, *J. C. Trejo 2812* (UPR); B, I from *J. C. Trejo 2725 & J. Pagán* (UPR); J, K from *J. C. Trejo & G. Irizarry 2740* (UPR). Illustration by Bobbi Angell.

branches with dark green leaves are conspicuous in the short vegetation canopy. Flowers have been recorded from June through October and December, and fruits in January, June, July, and October. Flowers have been observed replete with nectar.

Etymology. The specific epithet of *Reynosia vivesiana* honors Miguel "Papo" Vives from Quebradillas, Puerto Rico. Vives, formerly a chemistry teacher, is now widely known as an expert on plant identification in the island. In the past 30 years, he has been companion and collaborator with botanists responsible for the modern Flora of Puerto Rico. He devotes his time to the study of the plants of the island, and he has been an inspiration for newcomers studying the natural world of Puerto Rico.

Common names. The common name "cascarroya," also used for other Rhamnaceae in Puerto Rico, is recorded on the oldest specimen of *Reynosia vivesiana* (*GAG 30*, UPR). Another common name registered on the specimens *L. Gregory 263*, *308* (UPR) is "guama," which is evidently the source for the specific epithet of the putative species *R. guama*. I do not know if the application of the common name "guama" to the plants from Puerto Rico comes from a local informant (i.e., a genuine vernacular name), or if it is a translocation of the name from the Virgin Islands plants.

Paratypes. PUERTO RICO. **Mun. Guánica, Barrio Carenero, Guánica Forest Reserve:** near upper end of Hoya Las Picuas, 1.2–1.5 km due N of Playa Caña Gorda, *G. Proctor & E. Hernández 46476* (SJ); Los Granados trail, around water tank, *J. C. Trejo & J. Pagán 2725* (UPR); Maniel Rd., betw. Los Granados & Ojo de Agua trails, *J. C. Trejo & G. Irizarry 2738* (UPR), *J. C. Trejo & G. Irizarry 2740* (UPR); Maniel Rd., betw. Ojo de Agua & Cobanas trails, *J. C. Trejo & G. Irizarry 2741* (UPR), *J. C. Trejo & G. Irizarry 2742* (UPR); Rd. 333, 0.5 km E of Copamarina entrance, N side of rd., *J. C. Trejo & G. Irizarry 2743* (UPR); Rd. 333, E side of Caña Gorda beach entrance, *J. C. Trejo*, *R. Rivera & A. García 2767-A* (UPR); Caña Gorda, Nov. 1958, *R. Woodbury s.n.* (NY, UPR 26635); close to camp, *L. Gregory 308* (MAPR, UPR, US). Unspecified localities, whether as Guánica, Guánica Forest, Guánica Forest Reserve, or Guánica Insular Forest, which may belong to Municipalities of Guánica, Guayanilla, or Yauco: *GAG 30* (UPR), *L. Gregory 263* (UPR), *H. Cowles 2582* (UPR), *E. Little 13221* (GH, NY, UPR), coastal thickets, *A. Liogier 10791* (US), 26 May 1964, *R. Woodbury s.n.* (UPR 26839), 3 Dec. 1969, *R. Woodbury s.n.* (NY, UPR 26263), June 1971, *R. Woodbury s.n.* (NY, UPR 8533), June 1973, *R. Woodbury s.n.* (UPR 1876), *A. Liogier*, *P. Liogier & L. F. Martorell 29487* (UPR).

The Puerto Rican Bank region, which consists of the islands of Puerto Rico, Vieques, Culebra, and the Virgin Islands, has four species in the genus *Reynosia*. *Reynosia vivesiana* and *R. krugii* Urban are both endemic to Puerto Rico, *R. guama* is restricted to the Virgin Islands, and *R. uncinata* Urban is known from Hispaniola, Puerto Rico, and the Virgin Islands.

Key to the Species of *Reynosia* Native to Puerto Rico and the Virgin Islands

1a. Twigs, stipules, and adaxial side of petioles glabrous; stipels and axils scarcely puberulous or glabrous; fruits ca. 9 mm long; seeds ca. 7 mm long . . . . . *R. vivesiana*
1b. Twigs, stipules, and adaxial side of petioles puberulous; stipels and axils densely puberulous; fruits to 17 mm long; seeds to 15 mm long 2
2a. Leaves to 3 cm long, typically obdeltoid to oblong, with a downward-pointing spiny mucro . . . . . *R. uncinata*
2b. Leaves to 8.5 cm long, lanceolate, ovate, elliptic, oblong, or orbicular, with a forward-pointing soft mucro 3
3a. Leaves ovate, elliptic, oblong, or orbicular, base rounded to subcordate, apex emarginate to obcordate . . . . . *R. guama*
3b. Leaves lanceolate, ovate, or elliptic, base rounded to obtuse, apex shortly acuminate to cuspidate . . . . . *R. krugii*

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Lectotypification of *Myriophyllum oguraense* (Haloragaceae)

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Abstract. The lectotype is designated for *Myriophyllum oguraense* Miki, a species described from Japan in 1934. This taxon is listed as an endangered species in Japan. Among Asian taxa, *M. oguraense* is distinguished by its monoecious habit and glaucous leaves.

Key words: China, Haloragaceae, Japan, lectotypification, *Myriophyllum*.

Myriophyllum oguraense Miki (Haloragaceae) is an aquatic species confined to East Asia with a disjunct distribution between Japan (Miki, 1934, 1937; Hara, 1954; Ohwi, 1965; Iwatsuki, 1992; Ohwi & Kitagawa, 1992; Kadono, 1994) and China (Yu et al., 2002a, b). It is readily distinguished from other Asian species of the genus by its monoecious habit, glaucous floral leaves each with seven to nine (to 13) incurved and overlapping pinnae, and long cylindrical turions. This species has been listed as endangered in Japan by the Environmental Agency of Japan (2000) due to the potential threats of increased loss, fragmentation, and degradation of suitable habitat. This species will also be recorded by the *Flora of China* (J. Chen, pers. comm.). While revising the Asian *Myriophyllum* L., an evaluation of type material for *M. oguraense* led us to conclude that the name *M. oguraense* required lectotypification.

Myriophyllum oguraense was proposed as a new taxon by Miki (1934), based on his gatherings from three localities in Honshu, Japan, i.e., "Honshu: Prov. Yamashiro: Pond Ogura (*S. Miki!*, s.d.); Honshu: Prov. Yamashiro: Pond Takara (*S. Miki!*, *9. XI. 1925*); Honshu: Prov. Ohmi: Kaya in Omatsu (*S. Miki!*, *13. XI. 1932*)." In the protologue of *M. oguraense*, Miki provided a full description with detailed illustrations showing a floral leaf (1934: fig. 8D) and staminate and pistillate flowers (1934: fig. 8B, C), as well as a plate showing the inflorescences (1934: pl. IA). However, he did not designate a single specimen as the type of this species but referred to all three gatherings as types. Therefore, these specimens are regarded as syntypes under Art. 9.4 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006).

Our examination of the original material of *Myriophyllum oguraense*, which is deposited in the Osaka Museum of Natural History (OSA), revealed that this consists of 25 specimens on separate sheets. All were collected and identified entirely by Miki, who labeled them with collection dates and localities, but without collection numbers. After examining these 25 specimens, we found that all agree with the description of *M. oguraense* and correspond to the three localities and dates indicated in the protologue. Therefore, these 25 sheets all represent syntypes from the three localities and dates (Miki, 1934). It is appropriate that a lectotype of the name *M. oguraense* should be selected from the 25 sheets in OSA.

Of the original material, "Honshu: Prov. Yamashiro: Pond Takara (*S. Miki 9. XI. 1925*)" and "Honshu: Prov. Ohmi: Kaya in Omatsu (*S. Miki 13. XI. 1932*) [the location Kaya is not known precisely now, it may be a pond near Lake Biwako]" are single specimens, which are strictly vegetative and labeled with collection dates, while "Honshu: Prov. Yamashiro: Pond Ogura (*S. Miki*)" consists of 23 specimens collected at different times from 1922–1927, i.e., 24 Apr. 1922 (one sheet, OSA 217549), 28 May 1923 (one sheet, OSA 217550), 7 July 1923 (three sheets, OSA 217551, 217552, 217553), 29 Oct. 1923 (one sheet, OSA 217554), 4 Nov. 1925 (one sheet, OSA

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217555), 10 Nov. 1925 (one sheet, OSA 217556), 27 Nov. 1925 (one sheet, OSA 217557), 2 Dec. 1925 (one sheet, OSA 217558), 5 Dec. 1925 (four sheets, OSA 217559, 217560, 217561, 217562), 3 July 1926 (two sheets, OSA 217563, 217564), 2 Aug. 1926 (three sheets, OSA 217565, 217566, 217567), 2 Sep. 1926 (two sheets, OSA 217568, 217569), 21 Sep. 1926 (one sheet, OSA 217570), and 6 June 1927 (one sheet, OSA 217571). The reexamination of these 23 specimens revealed that only two of the three sheets (217565 and 217567), collected by Miki on 2 August 1927, bear flowers while the remaining 21 are entirely vegetative.

In this particular case, these latter two fertile specimens (*Miki s.n.*, OSA 217565, 217567) are candidates for lectotypification. Even though both sheets show adequate representation of flowers and floral leaves, OSA 217565 is preferable to OSA 217567 because the fragment capsule attached on the former contains a dissected flower that corresponds faithfully to the floral elements quoted in the protologue. It is obvious that this specimen (OSA 217565) was the one used by Miki for the illustration in the protologue of *Myriophyllum oguraense* (Miki, 1934: fig. 8B, C). It is also noteworthy that the specific epithet chosen by Miki ("*oguraense*") refers to the "Pond Ogura" from which these specimens originated. Therefore, we here select and designate sheet OSA 217565 as the lectotype of *M. oguraense*. We also add to this lectotype the collection date 2 August 1927, which is taken directly from the specimen label.

Myriophyllum oguraense Miki, Bot. Mag. (Tokyo) 48: 335. 1934. TYPE: Japan. Honshu: Prov. Yamashiro, Pond Ogura, 2 Aug. 1927, *S. Miki s.n.* (lectotype, designated here, OSA 217565).

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A Distinctive New Species of *Ouratea* (Ochnaceae) from the Jalapão Region, Tocantins, Brazil

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ABSTRACT. *Ouratea acicularis* R. Chacon & K. Yamamoto (Ochnaceae), a new species from the recently created Estação Ecológica Serra Geral do Tocantins, Jalapão region, Brazil, is described. *Ouratea acicularis* appears to be most closely allied to *O. oleifolia* (A. Saint-Hilaire) Engler. Both species share a pubescent indumentum on the young branches, leaf surfaces, inflorescence axes, and outer surface of the flower buds, as well as revolute leaves and acute flower buds. *Ouratea acicularis* is unique in the genus in its aciculate leaf blade, at least 4 times narrower than in *O. oleifolia*, with a strongly revolute margin that conceals the abaxial leaf surface except for the midrib, as well as its inconspicuous secondary venation and narrower flower buds. Anatomically, *O. acicularis* differs from other previously studied species of *Ouratea* Aublet in that the cells of the adaxial epidermis have an hourglass-shaped lumen, pluricellular forked hairs fused at the base, an unusually large cap of fibers and sclereids above the collateral vascular bundles, and in the predominantly 2-layered chlorenchyma. The stems of *O. acicularis* are noteworthy for the conspicuous secretory cavities of the cortex and secondary xylem, in which fibers and vessel members predominate.

RESUMO. Este trabalho descreve *Ouratea acicularis* R. Chacon & K. Yamamoto (Ochnaceae), espécie nova da recentemente criada Estação Ecológica Serra Geral do Tocantins, Região do Jalapão, Tocantins, Brasil. *Ouratea acicularis* se assemelha mais a *O. oleifolia* (A. Saint-Hilaire) Engler. Ambas as espécies apresentam indumento pubescente nos ramos jovens, em ambas as faces foliares, nos eixos da inflorescência e na superfície externa dos botões florais, bem como folhas revolutas e botões florais agudos. *Ouratea acicularis* é a única espécie do gênero que possui lâminas foliares aciculares, ca. quatro vezes mais estreitas do que em *O. oleifolia*, com margens foliares fortemente revolutas que escondem a face abaxial da folha exceto a nervura mediana, bem como pela venação secundária inconspícua e botões florais mais estreitos. Anatomicamente, *O. acicularis* difere das outras espécies já estudadas por apresentar células da epiderme adaxial com lúmen em forma de ampulheta, tricomas pluricelulares fundidos na base, uma capa excepcionalmente desenvolvida de fibras e esclereídeos sobre os feixes vasculares colaterais, e clorênquima predominantemente bi-estratificado. Os ramos de *O. acicularis* são dignos de nota pela presença de cavidades secretoras conspícuas no córtex e pelo predomínio das fibras e dos elementos de vaso e xilema secundário.

Key words: Brazil, IUCN Red List, Ochnaceae, *Ouratea*, South America.

The Central Brazilian Highlands are in the core area of the cerrado biome, a poorly protected biodiversity hotspot (Mittermeier et al., 1999). The Jalapão region, in eastern Tocantins, is one of the most underpopulated areas of this biome and, until recently, has remained virtually unknown to botanists. The biological importance of this region has been highlighted by several scientific expeditions (Proença et al., 2002; Reis et al., 2002; Scariot et al., 2002), and the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) has created a biological reserve in the area, the Estação Ecológica Serra Geral do Tocantins (Arruda & von Behr, 2002), which encompasses the smaller Parque Estadual do Jalapão. The Estação Ecológica Serra Geral do Tocantins constitutes the largest continuous reserve (716,306 ha.) that is entirely within the cerrado biome in Brazil.

Preliminary collections in the Estação Ecológica Serra Geral do Tocantins resulted in six taxa suspected of being new in Asteraceae, Bignoniaceae, Ebenaceae, Ochnaceae, Rutaceae, and Vochysiaceae (Proença et al., 2002), of which the Bignoniaceae has since been described as a new variety (Proença et al., 2007). This paper describes a new species of *Ouratea* Aublet (Ochnaceae). The new *Ouratea* was first collected by both James Ratter (E) and Rosana Farias Singer (UB) on the same expedition in 1998; the Ratter specimen at UB was chosen as the holotype because it is a representative collection in mature fruit, which is duplicated at E. Additional sets of material of this species have been collected in the same region during three scientific expeditions in 2001 and 2002 and distributed to Brazilian herbaria in the Distrito Federal, Goiás, and Tocantins.

The Neotropical genus *Ouratea*, distributed from Central to South America (Engler, 1876), comprises shrubs and trees that grow in lowland or highland forests or savannas, and sometimes in maritime thickets. The genus has a remarkable pseudo-apocarpic gynoecium with a gynobasic style and a gynophore that develops, in the ripe fruit, into a reddish carpophore that displays black mericarps derived from fertilized 1-ovulate units (Baum, 1951; Guédès & Sastre, 1981; Spujt, 1994; Barroso et al., 1999). *Ouratea* comprises nearly 300 binomials, but the number of valid species is not yet well established. It is important to note that more than 20% of these names were only recently described in regional floras of northern South America (e.g., Sastre, 1988, 2001; Maguire & Steyermark, 1989) and Central America (Whitefoord, 1992). This has increased the number of species known in the genus that have been poorly understood because of their limited distribution in undercollected regions. Although species circumscription in *Ouratea* is usually difficult as the genus includes many confusing species complexes (Yamamoto, 1989), some endemic species do have outstanding diagnostic features that make them sharply distinct. This appears to be the case of this new species described here.

Ouratea acicularis R. Chacon & K. Yamamoto, sp. nov. TYPE: Brazil. [Tocantins:] Mun. Mateiros, 53 km from Ponte Alta on rd. to Mateiros, 10°30′S, 47°11′W, 400 m, 16 Nov. 1998, *J. Ratter, S. Bridgewater, J. Fonsêca Filho & R. Farias 8115* (holotype, UB; isotype, E). Figure 1.

Frutex caespitosus 1–1.5 m; stipulae in foliis juvenilibus persistentes; *rami* juniores brevissime puberuli, internodiis 2–10 mm; folia erecto-patentia, petiolo brevi crasso suffulta, lamina lineari vel aciculari, 1.6–9 × 0.1–0.2 cm, chartacea, pungentia, margine forte revoluta, integerrima, supra paullum puberula demum glabra, subtus dense puberula, nervis lateralibus ubique inconspicuis. *Panicula* thyrsoidea, terminalis vel subterminalis, angusta, puberula, bracteolis persistentibus, pedicellis florum 6–8.5 mm, tenuibus. *Alabastrum* 4–5 × 2.5–3 mm, ovoideum, puberulum, apice acutum; sepalis 5, ca. 6 × 3 mm, ovatis, caducis; petalis 5, flavis; staminibus 10, transverse rugulosis; carpidiis 5, gynophoro columnari-cylindrico, apicem versus pentagono. *Monades* carpicae fertiles oblongae, carpophoro 2.5–5 × 4–7 mm, salmoneo, base angustato, recurvato, sursum expanso apicem versum pyriformi; mericarpia 1 ad 2, erecta vel obliqua; semen ca. 0.5 × 0.3 cm, testa membranacea; embryo plano-convexus, hypocotylo perpendiculari, loriformi. A specie simili *O. oleifolia* (A. Saint-Hilaire) Engler foliis laminis carentibus, linearibus, marginibus revolutis et venis inconspicuis secundariis, 1.6–9 × 0.1–0.2 cm differt.

Shrub 1–1.5 m tall, caespitose, probably a hemicryptophyte; stems erect or sometimes decumbent in fruiting plants, branches cylindrical, striate when young, puberulous; hairs minute, patent to weakly curved, pale golden. *Leaves* congested at the terminal branches; internodes 2–10 mm; stipules 2 per leaf node, persistent at least in younger leaves, 1.5–3 × 0.2–0.5 mm, triangular, with a dark (glandular?) basal spot, the margins sometimes revolute; petiole to 1 × 1.25 mm, stout; leaf blade 1.6–9 × 0.1–0.2 cm (rolled), chartaceous, linear or aciculate, apex pungent, base truncate, margins entire, strongly revolute and hiding nearly all the abaxial surface except for the midvein; adaxial surface puberulous when young, glabrescent with age, the midvein sulcate; abaxial surface puberulous, the midvein prominent; secondary veins inconspicuous on both surfaces. *Panicles* thyrsoid, terminal or subterminal at the distal leaf axils, narrow, isolated or in clusters of 2 or more; main axis 6.5–13 cm, lateral axes to 8.5 mm, cymules 1- to 3-flowered, shortly pedunculate, peduncles to 5 mm; bracts congested at bases of major axes, or isolated at bases of cymules, 2.25–3 × 0.5–0.8 mm, triangular,

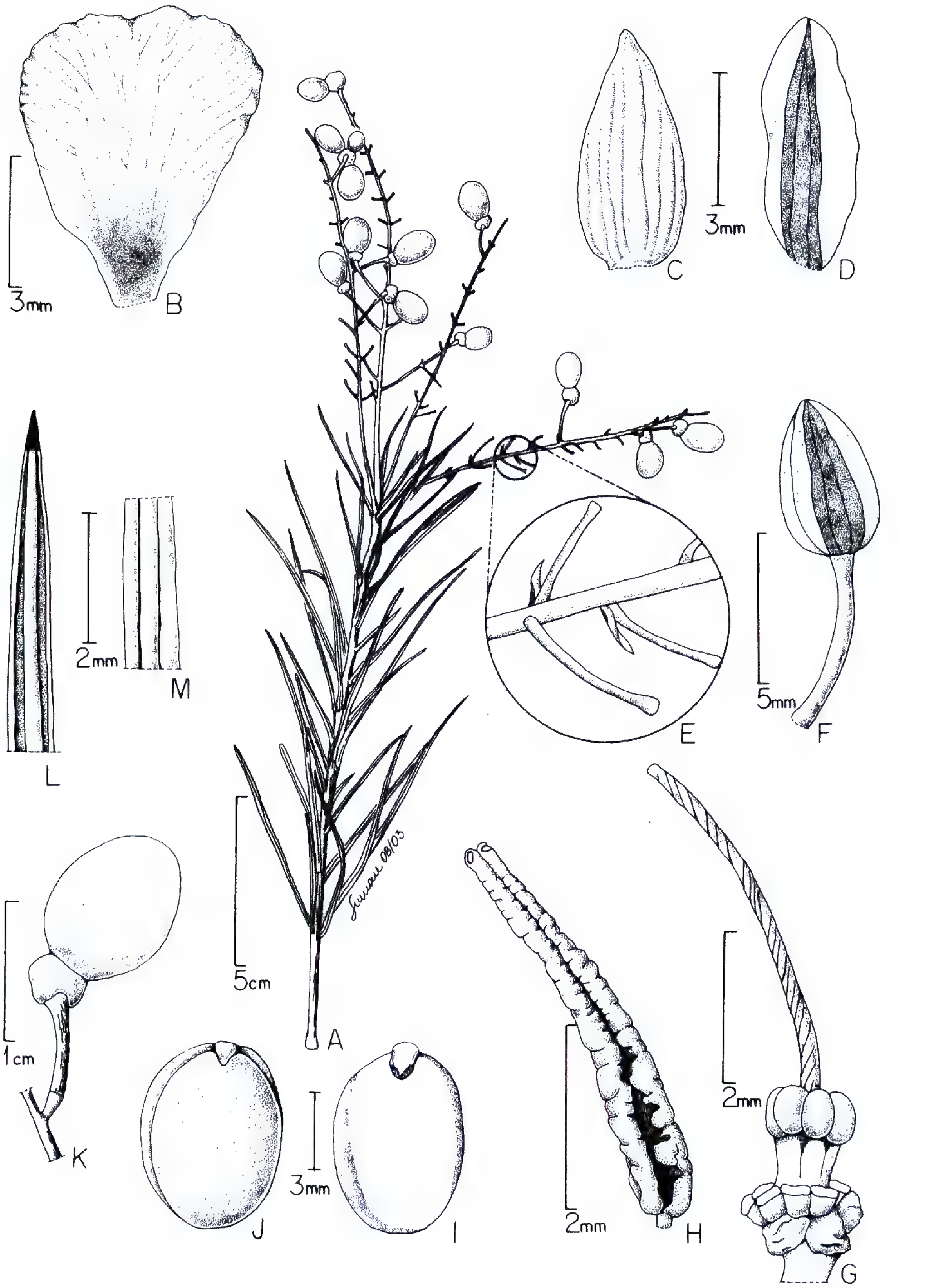


Figure 1. *Ouratea acicularis* R. Chacon & K. Yamamoto. —A. Habit. —B. Petal. —C. Internal sepal. —D. External sepal. —E. Bracts. —F. Flower bud. —G. Gynoecium. —H. Stamen. —I. Inner view of cotyledon. —J. Embryo. —K. Fruit. —L. Abaxial leaf surface. —M. Detail of abaxial leaf surface. A, I–M from *Ratter et al. 8115* (UB); B–H from *Cavalcanti et al. 2757* (CEN).

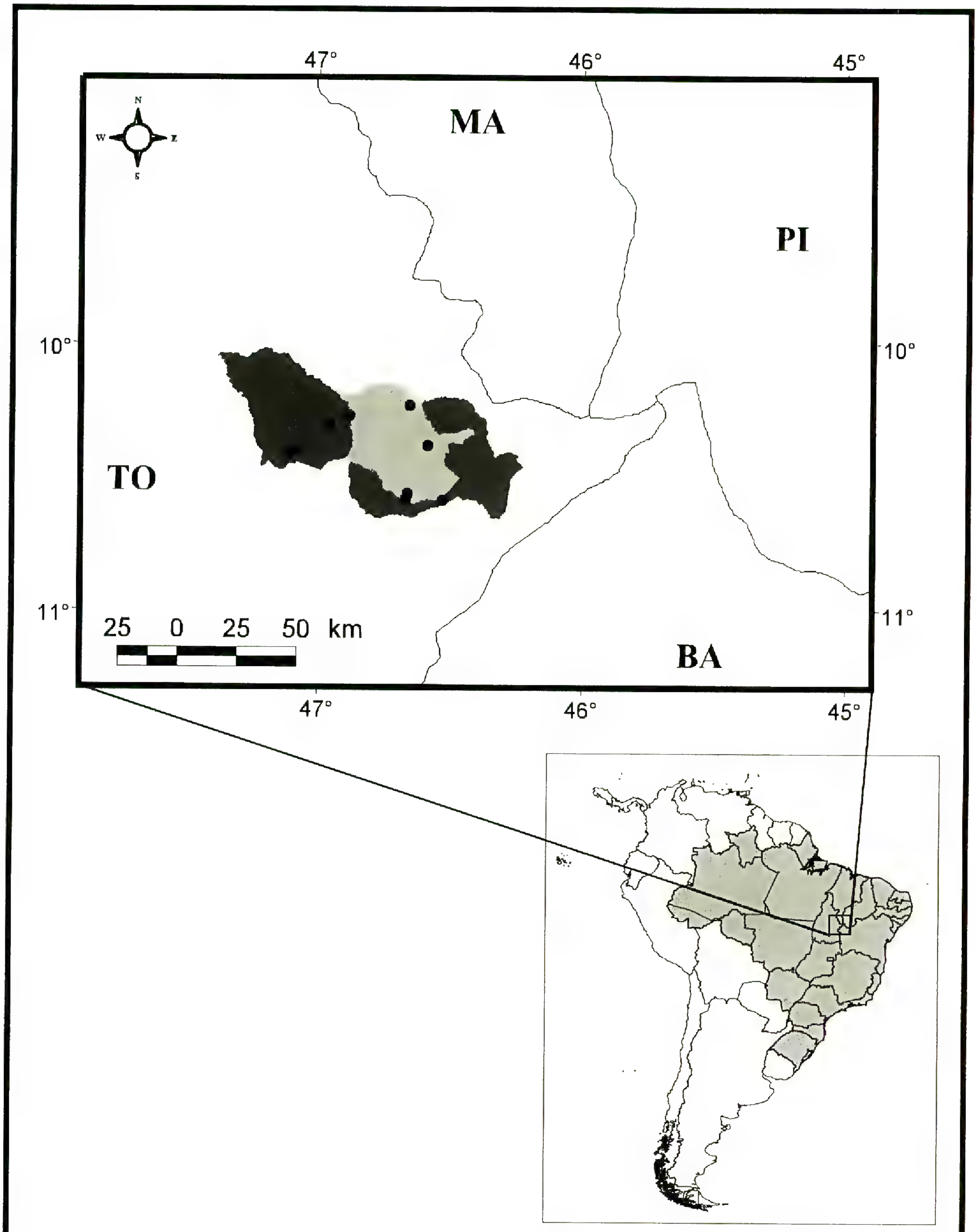


Figure 2. Geographic distribution of *Ouratea acicularis* R. Chacon & K. Yamamoto. Dark gray shading denotes Estação Ecológica Serra Geral do Tocantins; light gray shading denotes Parque Estadual do Jalapão. BA = Bahia, MA = Maranhão, PI = Piauí, TO = Tocantins.

concave, striate, acute; bracteoles to 1.5 × 0.5 mm, linear, isolated or in pairs, persistent; pedicel 6–8.5 mm, straight, puberulous, regularly slender in bud and flower, broadened at the base of the carpophore to 0.7–1 mm in ripe fruit. *Flower* bud 4–5 × 2.5–3 mm, ovoid, apex acute, base obtuse, puberulous; sepals 5, ca. 6 × 3 mm, ovate, abaxial surface puberulous, early caducous; petals 5, 6–8.5 × 4.5–5 mm, yellow, obovate to orbicular-flabellate, asymmetric, base unguiculate; stamens 10, straight, anthers subsessile, ca. 5 × 0.5 mm, subulate, transversely rugulose, poricidal; gynoecium superior, 5-carpellate, the columnar gynophore 0.5–1 mm, cylindrical to pentagonal near apex, fertile units 5, oblong, 0.5–1 × 1.1–1.2 mm; style ca. 4 mm, filiform; stigma punctiform, yellow. *Carpophore* 2.5–5 × 4–7 mm, salmon pink in the ripe fruit, mostly with a narrow and frequently curled basal portion expanding rather abruptly to a pyriform head; mericarps 1 or 2, erect or obliquely disposed on carpophore head, inflated, 1.1–1.6 × 0.7–1.2 cm, ellipsoid, opaque; pericarp thin; seed ca. 0.5 × 0.3 cm, testa membranaceous, slightly rugose, embryo ellipsoid, cotyledons plano-convex, hypocotyl strap-shaped, perpendicular to the cotyledon.

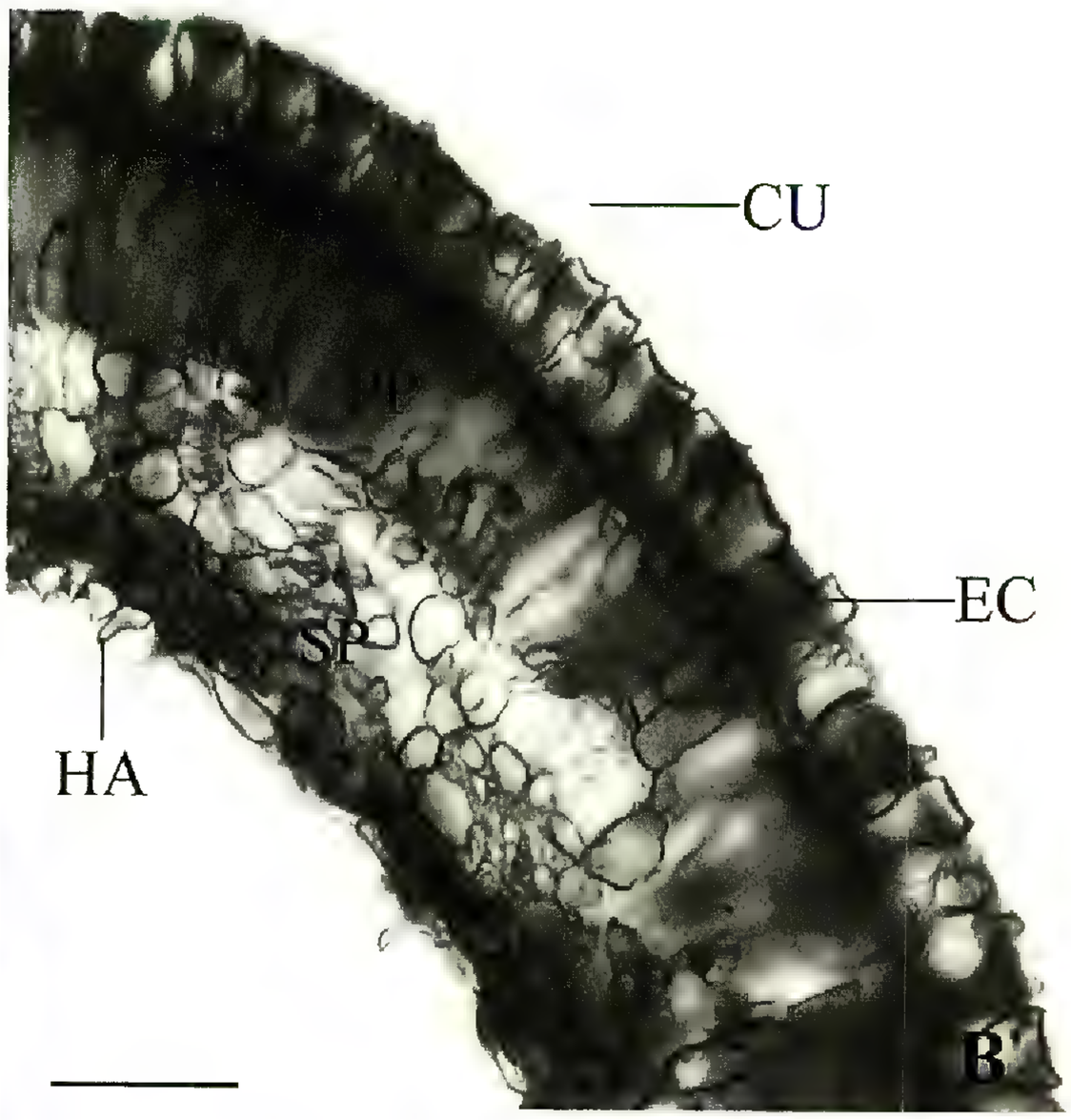
Distribution, ecology, and phenology. *Ouratea acicularis* is apparently a narrow endemic of the Jalapão region in the state of Tocantins, Brazil, growing between 400 and 500 m.s.m. (Fig. 2). It was collected in rocky or sandy-soiled cerrado, i.e., grassy fields with scattered low trees and shrubs to 2 m tall. Flowers have been collected in May and June, and immature fruits in June and November.

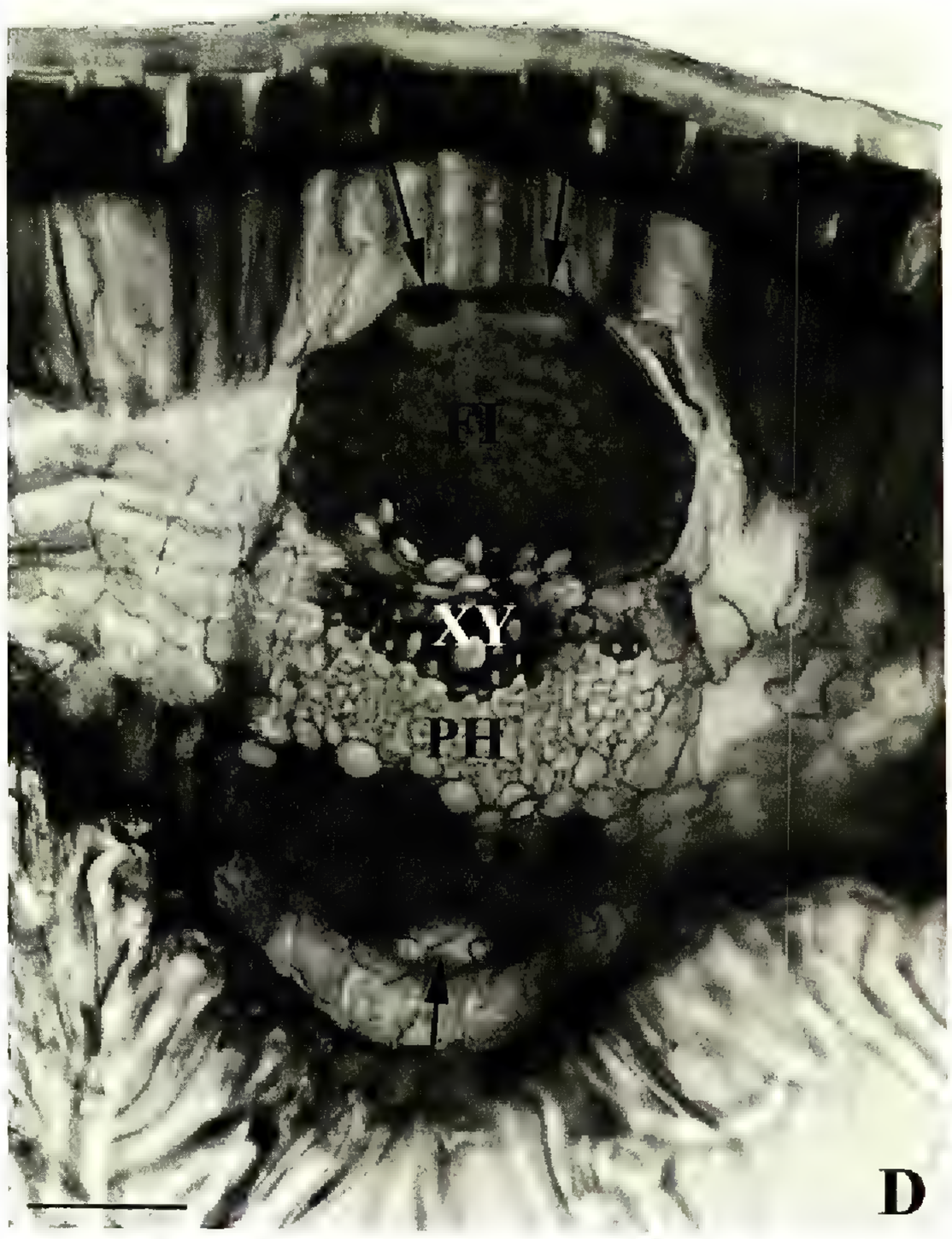
IUCN Red List category. *Ouratea acicularis* is a narrow endemic occurring in specialized habitats of the Jalapão region, with a geographic distribution estimated as less than 7000 km² and populations known to exist as no more than 10 isolated mature individuals. Based on this information and following IUCN Red List categories and criteria (IUCN, 2001), this species is assessed as Vulnerable (VU). However, it should be mentioned that all populations found are within the Estação Ecológica Serra Geral do Tocantins.

Discussion. Anatomical stem and leaf features that have not yet been recorded in the genus *Ouratea*, or in the family Ochnaceae, were found in *O. acicularis*. The anatomical characters of the new species were compared with *O. miersii* (Planchon) Engler, *O. multiflora* (Pohl) Engler, and *O. parviflora* Engler, based on a study by Yamamoto (1995). Because the anatomical characters of *O. acicularis* appear to be useful in distinguishing it from these congeneric species, the most outstanding of these features are described in Table 1.

Table 1. Comparison of anatomical characteristics of *Ouratea acicularis* with three other species of *Ouratea* studied by Yamamoto (1995).

	O. acicularis	*O. miersii*	*O. multiflora*	*O. parviflora*
Stem				
Epidermis cells	rectangular	rectangular or papillose	rectangular	rectangular
Indumentum	thick cuticle and unicellular hairs	glabrous or papillose hairs	—	—
Peridermis cells	5-layered, rectangular with all walls thickened	10-layered or more	—	—
Cortex	conspicuous secretory cavities present	secretory cavities absent	secretory cavities absent	secretory cavities absent
Leaf				
Stomata	hypostomatic	hypostomatic	hypostomatic	hypostomatic
Adaxial surface	thick cuticle, few hairs	thick cuticle, glabrous	thin cuticle, glabrous	glabrous
Adaxial epidermis cells	rectangular, uniformly thick-walled cells with hourglass-shaped lumen	cell walls not thickened, lumen cell-shaped	cell walls not thickened, lumen cell-shaped	cell walls not thickened, lumen cell-shaped
Abaxial surface	thin cuticle, many pluricellular hairs, papillose cells	thin cuticle	thin cuticle, glabrous	—
Abaxial epidermis cells	rectangular	pyriform or rounded	variable	variable
Cristarque cells	scarce	abundant	abundant	abundant





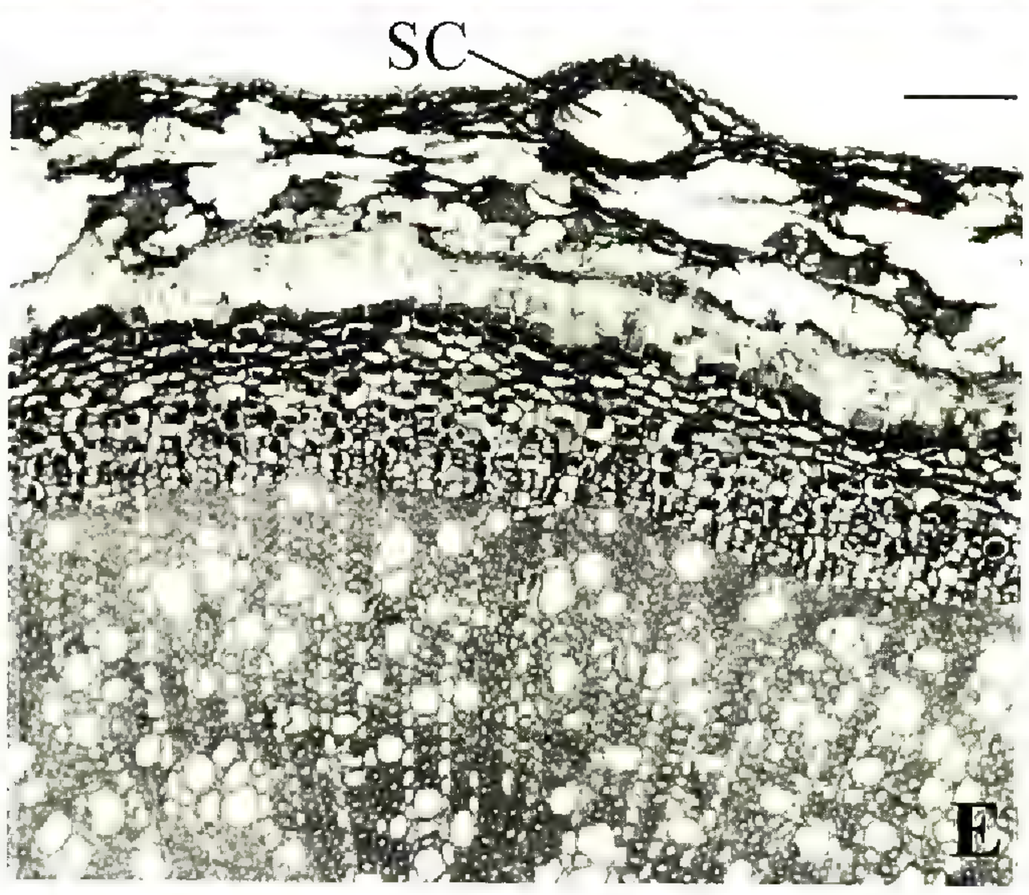


Figure 3. Leaf and stem anatomy of *Ouratea acicularis* R. Chacon & K. Yamamoto. —A. Cross section of leaf. —B. Detail of leaf cross section. —C. Abaxial leaf surface showing pluricellular forked hairs. —D. Cross section of vascular bundles. —E. Cross section of stem secondary growth. CU = cuticle, EC = epidermal cells, FI = fibers, HA = hairs, PH = phloem, PP = palisade parenchyma, SC = secretory cavities, SP = spongy parenchyma, XY = xylem. Arrows signify cristarque cells. Scale bars = 50 μm.

Ouratea acicularis also appears to be anatomically unique in the genus (Fig. 3). Although the leaves of this species are hypostomatic with paracytic stomata, as is common in *Ouratea*, *O. acicularis* has the adaxial epidermis composed of cells with an hourglass-shaped lumen, here described for the first time in the genus, as well as the leaf indumentum with pluricellular forked hairs fused at the base. Until now, only unicellular

Table 2. Morphological comparison of similarities and differences between *Ouratea acicularis* and *O. oleifolia*.

	O. acicularis	*O. oleifolia*
Leaf blade shape	ca. 1.6–9 × 0.1–0.2 cm (rolled); margins entire, revolute (only the midvein uncovered)	ca. 5–8 × 1–2.5 cm; margins entire, revolute (almost all the abaxial surface uncovered)
Lateral leaf veins	immersed, inconspicuous	immersed, the secondary ones sharply discernible, the intersecondary veins inconspicuous
Indumentum	puberulous, covering the young branches, the midvein on both faces, the inflorescence axes and the flower bud (lower surface of the sepals)	puberulous, covering the young branches, the inflorescence axes and the flower bud (lower surface of the sepals), and subvelutinous indument covering both leaf blade surfaces, mostly the abaxial one
Internode	2–10 mm long	≥ 7 mm long at distal nodes; leaves usually sparser basally
Flower bud	4–5 × 2.5–3 mm, ovoid, apex acute, base obtuse, puberulous	4–6 × 3–5 mm, ovoid, apex acute, base obtuse, puberulous
Habitat	rocky cerrados or grassy fields with scattered low trees and shrubs to 2 m tall on red sandy soil	savannas or similar sclerophyllous vegetation with small trees on sandy soil
Distribution	state of Tocantins, apparently endemic to the Jalapão region	states of Bahia, Goiás, Minas Gerais, Pernambuco, and Tocantins

hairs fused at the base and free pluricellular hairs had been described in *Ouratea* (see Solereder, 1908). The high degree of development of the cap of fibers and sclereids above the collateral vascular bundles is also unsurpassed in the genus. The most noteworthy anatomical novelty found in *O. acicularis* is the conspicuous secretory cavities in the stem cortex. The secondary xylem axial system is also outstanding due to the dominance of fibers and vessel members, with hardly any parenchyma. Unfortunately, *O. oleifolia*, which seems to be the most morphologically similar species, has not been studied anatomically.

The acicular leaf blade of *Ouratea acicularis* has margins so strongly revolute that they conceal the abaxial surface, leaving only the midrib uncovered (Figs. 1, 3); this kind of leaf is apparently unique to this species within the genus *Ouratea*. Most species of *Ouratea* have elliptic, oblong, ovate, cordate, or obovate leaves with regularly flattened surfaces and only rarely revolute margins, which never conceal the entire abaxial leaf surface. Also, on the adaxial surface the lateral veins are immersed and inconspicuous in *O. acicularis*, while in most species of *Ouratea* the lateral veins are clearly visible, especially the secondary ones that are characteristically curved upward, with most ending at the margins or occasionally forming anastomosing loops (see descriptions in Engler, 1876; Maguire & Steyermark, 1989).

Morphological, ecological, and geographical similarities suggest that *Ouratea acicularis* belongs to the taxon *O. oleifolia* sensu Engler (1876) and is most closely related to that species. *Ouratea oleifolia* is distributed in the more arid savannas of northern Minas Gerais and Bahia to Pernambuco, Piauí, and eastern Tocantins (former Goiás); this distribution area is much wider than but overlaps with that of *O. acicularis*. Thus, ecological and geographical features corroborate the relationship that morphological characters suggest between *O. acicularis* and *O. oleifolia*.

Although the wide circumscription of *Ouratea oleifolia* proposed by Engler (1876) is adopted in this paper, this is not a consensus, as Engler's circumscription was rejected by Tieghem (1902). Engler (1876) united several taxa that are treated as distinct by previous or later taxonomists as varieties of *O. oleifolia* based on slight differences in indumentum density (Tieghem, 1902).

Regardless of the classification accepted for this complex, *Ouratea acicularis* is sharply distinct from *O. oleifolia* sensu Engler (1876) by its linear-aciculate leaf blade that is at least four times narrower than in *O. oleifolia*, with a strongly revolute margin that conceals the abaxial leaf surface except for the midrib, and inconspicuous secondary venation on the adaxial surface, as well as by its narrower flower buds (see Table 2 for a detailed comparison).

Paratypes. BRAZIL. **Tocantins**: Mun. Mateiros, 10°24′S, 47°05′W, *R. Farias, J. Fonsêca Filho, S. Bridgewater & J. A. Ratter 157* (UB); Mun. Mateiros, Dunas, 10°35′S, 46°40′W, *A. B. Sampaio, P. L. Simpson Jr., R. Farias & L. C. Milhomens 545* (UB); 15 km from Mateiros on rd. Mateiros–Ponte Alta, 10°35′19″S, 46°31′42″W, *T. B. Cavalcanti, A. O. Scariot, A. C. Sevilha, G. Pereira-Silva & A. B. Sampaio 2757* (CEN, UEC).

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Roegneria heterophylla, a New Combination for *Roegneria* (Poaceae, Triticeae) from Lebanon

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ABSTRACT. *Agropyron panormitanum* Parlatore var. *heterophyllum* Bornmüller ex Melderis (Poaceae, Triticeae) is transferred to the genus *Roegneria* K. Koch based on its ploidy and genome. The taxon was described from Lebanon and is recognized at species rank as the new combination *R. heterophylla* (Bornmüller ex Melderis) C. Yen, J. L. Yang & B. R. Baum. The taxon is hexaploid, with the StStStStYY genome, and therefore its taxonomic relationship is better reflected and assessed within the genus *Roegneria*, a genus with genomic constitution StStYY or StStStStYY. Furthermore, it should be treated as a new species rather than as a variety because the two have separate and independent gene pools as demonstrated by crossing experiments.

Key words: *Agropyron*, Lebanon, Poaceae, *Roegneria*, Triticeae.

Melderis (1960) described the taxon *Agropyron panormitanum* Parlatore var. *heterophyllum* Bornmüller ex Melderis. Bornmüller is credited for stating that it differs from the typical variety of the species by its narrower leaves, smaller florets (1.2–1.4 mm), two or three well-developed florets per spikelet, and glabrous glumes and shorter anthers (ca. 3 mm). Tzvelev (1970) transferred *A. panormitanum* to *Elymus* L. as *E. panormitanus* (Parlatore) Tzvelev. Although Jensen and Salomon (1995: 731) used the name "*Elymus panormitanus* (Parl.) Tzvelev var. *heterophyllus* Bornm. ex Meld.," Melderis never treated the species or variety in *Elymus* and the combination was not validly published by Jensen and Salomon (1995). Although they adopted the combination in the form that satisfies Art. 33.1 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006), they failed to provide "a full and direct reference" to the "author and place of valid publication" of the basionym as required on or after 1 January 1953 under Art. 33.4. However, Salomon had done so earlier (Salomon, 1994), providing the author and place of valid publication of the basionym on page 18 and adopting the name on page 19.

Salomon's treatment (1994: 18–19) of the epithet *heterophyllus* is, however, rather strange. He cited "*Agropyron panormitanum* var. *heterophyllum* Bornm. ex Meld." as an apparently unqualified synonym of *Elymus panormitanus*, then proceeded to discuss *E. panormitanus* var. *heterophyllus* Bornmüller ex Melderis with clear acceptance of the name, but finally suggested that "it should be treated as a new species rather than a variety." He did not suggest a name for this species, and there is no suggestion that he was treating *E. panormitanus* as an alternative name for *E. panormitanus* var. *heterophyllus*, and so the name cannot be rejected under Art. 34.2 (McNeill et al., 2006; McNeill, pers. comm.). Indeed, he was evidently accepting *E. panormitanus* var. *heterophyllus* as the current name of the taxon, which, despite the confusing synonymy of the basionym, he clearly considered distinct from *E. panormitanus* var. *panormitanus*, not only noting the differences but excluding specimens of the variety from the morphological description of the species.

Jensen and Salomon (1995) carried out cytogenetic studies in *Agropyron panormitanum* var. *heterophyllum*. They reported that this taxon was hexaploid with 42 somatic chromosomes and possessed the StStStStYY genome and that it crossed with *A. panormitanum* var. *panormitanum*. They also reported that stainable pollen ranged from 5%–10% and averaged 1.3% in the experimental F_1 pentaploid hybrids. Cross-compatibility and fertility between

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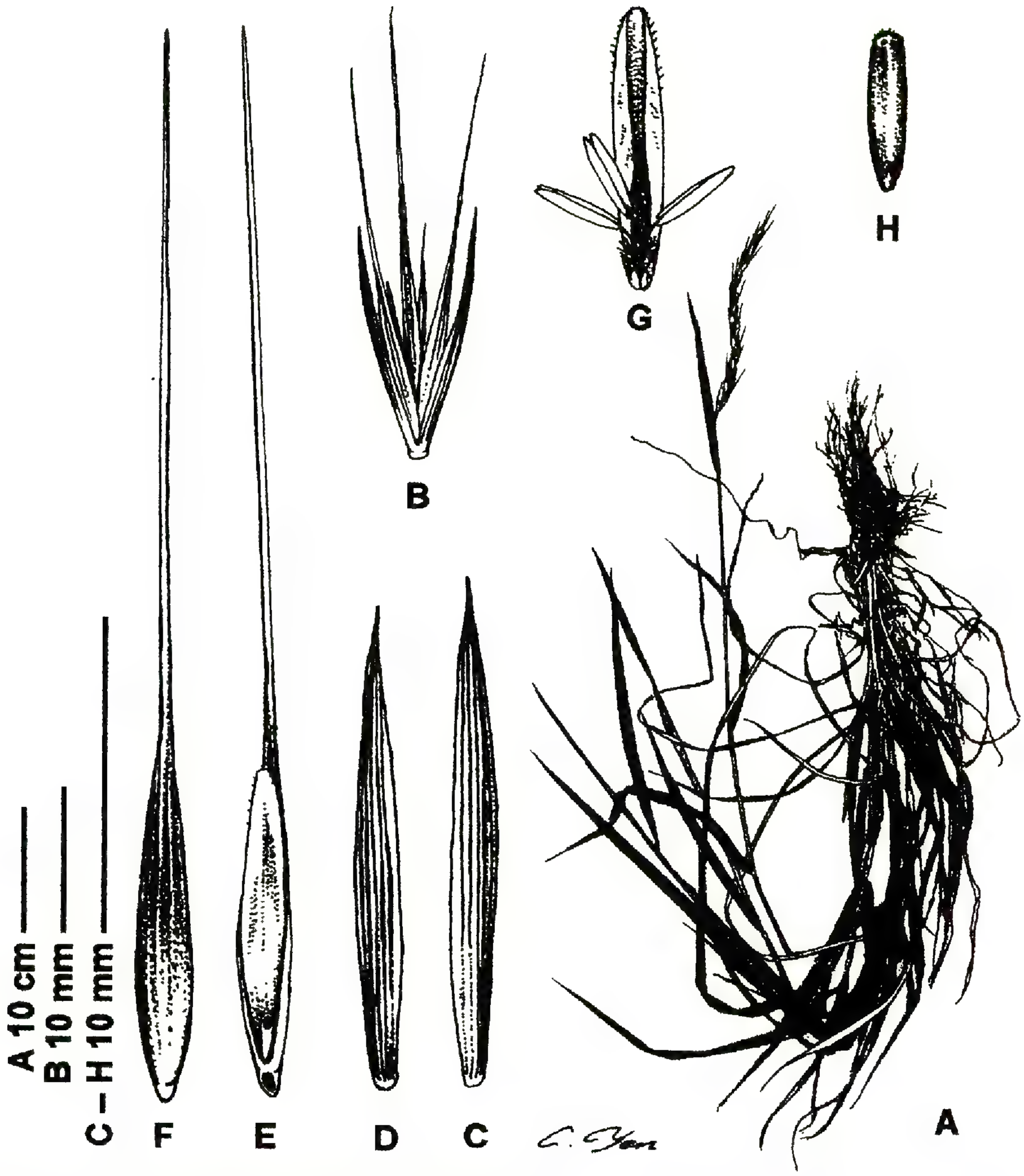

Figure 1. *Roegneria heterophylla* (Bornmüller ex Melderis) C. Yen, J. L. Yang & B. R. Baum. —A. Whole plant. —B. Spikelet. —C. Second glume. —D. First glume. —E. Ventral view of floret. —F. Dorsal view of floret. —G. Palea, lodicules, anthers, and feather-like stigma. —H. Caryopsis. Drawn by C. Yen from a specimen grown from seed accession *PI 235086*, collected in Israel, received from K. B. Jensen, Logan, Utah, U.S. Department of Agriculture, Agricultural Research Service.

these two taxa are significantly lower than 50%, which suggests that the two taxa have their own independent gene pool (e.g., Kihara, 1982, in regard to wheats). Salomon (1994: 19) correctly considered that "it should be treated as a new species rather than as a variety under *E. panormitanus*. It is derived from [a cross of] *E. panormitanus* and a diploid *Pseudoroegneria* species through inter-generic hybridization." Unfortunately, he changed his mind the following year (Jensen & Salomon, 1995).

The genomic constitution of this taxon is StStStStYY (Yen et al., 2005) and the foregoing arguments (e.g., independent gene pool) therefore relegate it to species level within the genus *Roegneria* K. Koch. The origin of this taxon is derived from *R. panormitana* (Parlatore) Nevski, StStYY genome, and an StSt genome donor species of *Pseudoroegneria* (Nevski) Á. Löve. Due to the dominant genetic effect (Jensen & Salomon, 1995) of their parental species, most phenotypic characters of *R. panormitana* and *R. heterophylla* (Bornmüller ex Melderis) C. Yen, J. L. Yang & B. R. Baum are morphologically similar. Therefore, it is difficult morphologically to separate them, but the two can be clearly distinguished by their chromosome number. *Roegneria heterophylla* is a hexaploid taxon ($2n = 6x = 42$), whereas *R. panormitana* is a tetraploid ($2n = 4x = 28$).

Roegneria heterophylla (Bornmüller ex Melderis) C. Yen, J. L. Yang & B. R. Baum, comb. et stat. nov. Basionym: *Agropyron panormitanum* Parlatore var. *heterophyllum* Bornmüller ex Melderis,

K. H. Rechinger f., Zur Flora von Syrien und Libanon. Ark. Bot. (Ser. 2) 5: 69. 1960. *Elymus panormitanus* (Parlatore) Tzvelev var. *heterophyllum* (Bornmüller ex Melderis) B. Salomon, Nordic J. Bot. 14: 18–19. 1994. TYPE: "Lebanon: Ain Zhalta, reg. subalp., in declivitatibus occ., 1200–1300 m, *Bornmüller 13036*" (holotype, JE not seen; isotypes, BM, G, LD). Figure 1.

Perennial, tufted, without rhizomes; culms erect or geniculate at base, ca. 100 cm, glabrous to densely pilose at upper part of internode, nodes glabrous. Leaf sheaths glabrous or pilose; leaf blades flat, ca. 25 cm × (2.5–)5 mm, scabrous to villous adaxially, abaxially glabrous, scabrous or pilose. Spikes erect or slightly curved, tenuous, 10–16.5 cm, 7 to 11 spikelets per spike, loosely arranged; rachis internodes 10–18 × 1–1.7 mm, glabrous or sparsely scabrous on the back, angles setulose. Spikelets green, narrowly lanceolate, subsessile, pressed close to rachis, (12–)15–20 mm (excepted awn), 2 to 3 florets; internode of rachilla setulose and bristly on upper part; glumes subequal, linear-lanceolate or lanceolate, coriaceous, with narrow transparent scabrous margins, lower glumes 16–24 × 1.6–2.5 mm; upper glumes 17–24.5 × 2–2.5 mm, (5 to)7- to 9-nerved, nerves scabrous, adaxially densely puberulous becoming densely pilose near the base of the glumes, tip gradually narrowing into mucro or a ca. 5 mm awn; lemmas narrowly lanceolate, glabrous on back, gradually scabrous on upper part, pubescent near the base, 9–15 × ca. 2 mm, 5-nerved clearly at upper part, (10–)20–32(–35) mm awn; callus sparsely setulose; palea slightly shorter than lemma, tip broadly rounded, ciliate along apical 1/3 from tip of 2 keels; anthers yellow, 3–5 mm.

Cytology. $2n = 6x = 42$, genomic constitution StStStStYY.

Distribution. Lebanon (*Bornmüller 13036*, isotypes), Israel (*A. Danin s.n.*, 1 June 1987, J), Syria (*P. Mouterde 10299*, *12431*, *2648*, *7976*, all in G), and other specimens cited in Salomon (1994: 19).

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Habenaria pseudoglaucophylla (Orchidaceae), a New Species from Minas Gerais, Brazil

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ABSTRACT. *Habenaria pseudoglaucophylla* J. A. N. Batista, R. C. Mota & N. Abreu (Orchidaceae, Orchideae, Habenariinae), a new species from the state of Minas Gerais, Brazil, is described and illustrated. The species was first collected in 1970, but previously misidentified as *H. glaucophylla* Barbosa Rodrigues and *H. umbraticola* Barbosa Rodrigues. Distinctive features of the new species are the rosulate leaves, the deeply tripartite lip, the oblong posterior petal lobe with a truncate apex, and the short, tooth-like anterior petal lobe. The new species occurs in campo rupestre vegetation, usually associated with quartzite outcrops.

RESUMO. *Habenaria pseudoglaucophylla* J. A. N. Batista, R. C. Mota & N. Abreu (Orchidaceae, Orchideae, Habenariinae), uma nova espécie para o estado de Minas Gerais, é descrita e ilustrada. A espécie foi coletada pela primeira vez em 1970, mas identificada erroneamente como *H. glaucophylla* Barbosa Rodrigues e *H. umbraticola* Barbosa Rodrigues. Caracteres distintivos para a nova espécie são as folhas rosuladas, o labelo profundamente tripartido, o segmento posterior das pétalas oblongo, com ápice truncado e o segmento anterior das pétalas curto, dentiforme. A nova espécie ocorre em campo rupestre, geralmente associada a afloramentos de quartzito.

Key words: Brazil, campo rupestre, *Habenaria*, IUCN Red List, Minas Gerais, Orchidaceae.

The genus *Habenaria* Willdenow (Orchidaceae, Orchideae, Habenariinae) has a temperate and pantropical distribution, and its main centers of diversity are in Brazil, southern and central Africa, and East Asia (Kurzweil & Weber, 1992). *Habenaria* is the only representative of subtribe Habenariinae in the New World. Brazil, with 165 to 170 species (Hoehne, 1940; Pabst & Dungs, 1975), is the country with the largest number of *Habenaria* species in the New World and possibly worldwide. In Brazil, the main centers of diversity for the genus are the cerrado biome, a species-rich savanna vegetation covering 2 million km² of central Brazil (Ratter et al., 1997), and the campo rupestre vegetation of the central and southeastern regions of the country. Minas Gerais, with about 81 species (Pabst & Dungs, 1975), has been the state with the highest number of recorded species. In the course of a survey of the genus in Minas Gerais, a new species was found, which is described and illustrated here.

Habenaria pseudoglaucophylla J. A. N. Batista, R. C. Mota & N. Abreu, sp. nov. TYPE: Brazil. Minas Gerais: Mun. Catas Altas, Serra do Caraça, 1200 m, Gruta do Padre Caio, 20 Mar. 2005 (fl.), *R. C. Mota 2818* (holotype, BHCB; isotype, CEN). Figures 1, 2.

Species haec *Habenariae glaucophyllae* Barbosa Rodrigues similis, sed ab ea floribus paulo majoribus, corolla viridi, petali segmento posteriore oblongo apice truncato

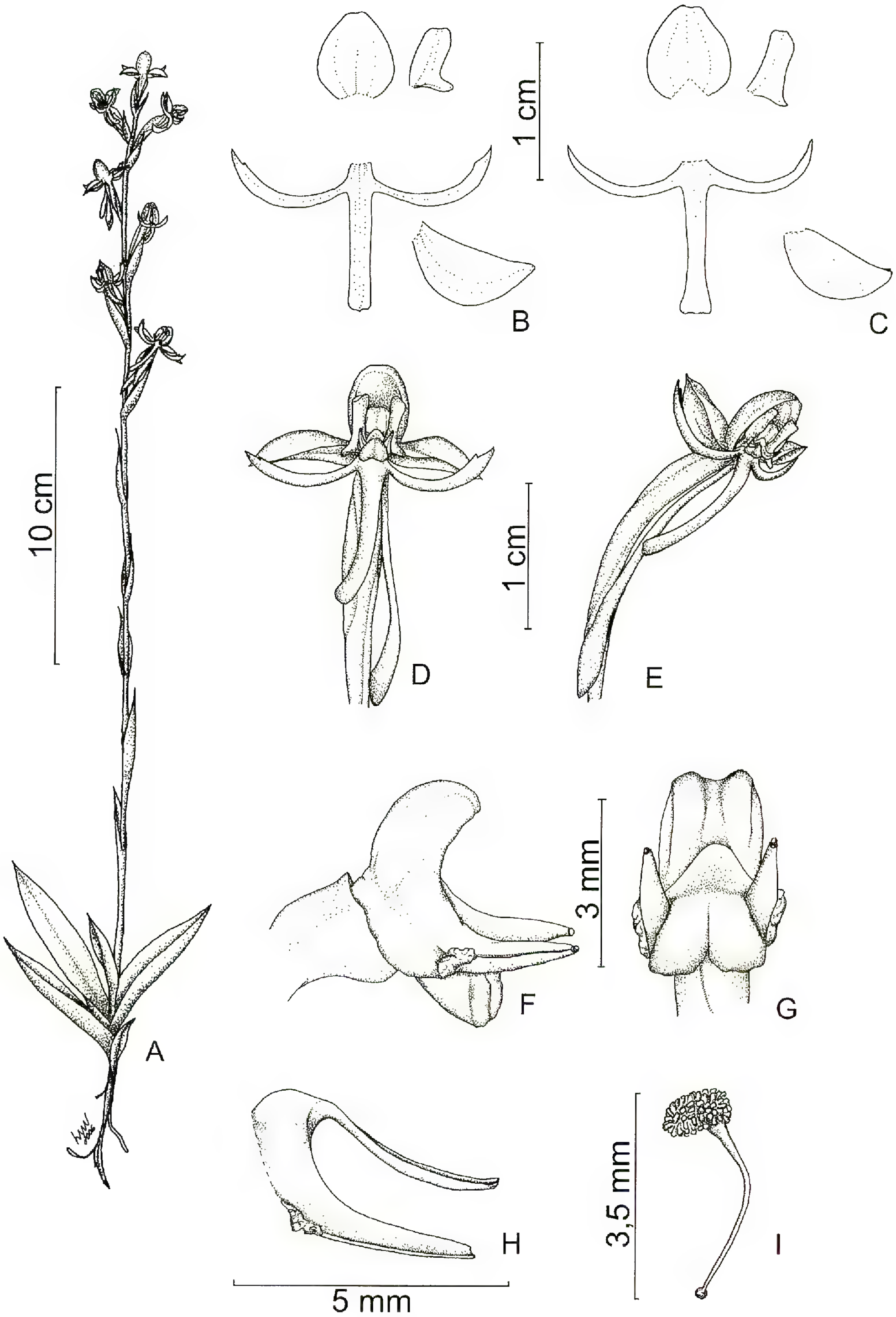

Figure 1. *Habenaria pseudoglaucophylla* J. A. N. Batista, R. C. Mota & N. Abreu. —A. Habit. —B, C. Perianth. —D. Flower, front view. —E. Flower, side view. —F. Column, side view. —G. Column, front view. —H. Rostellum, side view. —I. Hemipollinarium. Drawn by Luiz Menini Neto from *Abreu et al. 73* (CESJ), except for C and H from the type *Mota 2818* (BHCB).

Figure 2. *Habenaria pseudoglaucophylla* J. A. N. Batista, R. C. Mota & N. Abreu. —A. Plant, in rocky, iron-rich slopes. —B. Flower, 3/4 side view. Scale bars: A = 3 cm, B = 5 mm. Photographed from live specimens from Morro do Chapéu (*Batista 1967*, BHCB).

atque segmento mediano labelli majore (9–11 mm longo) apice truncato distinguitur; etiam occurrit in campis rupestribus.

Terrestrial herb; *roots* few, ca. 0.7 mm wide; *tuber* ellipsoid, ca. 13 × 7 mm; *stem* erect, terete, 16–33 cm (including the inflorescence), 1.5–4 mm wide. *Leaves* basal, 5 to 8, sheathing, lanceolate, elliptic, or obovate, 2.1–8.3 × (0.7–)1.7–3.5 cm, membranaceous, rosulate, adaxially light green, abaxially greenish silver, base attenuate, margins united to 1/8 of the leaf length, apex acuminate, mucronate. *Inflorescence* 20–30 cm, few flowered, lax; peduncle 14–20 cm, with 2 to 5 sheath-like bracts, spiral, appressed, lanceolate to ovate-lanceolate, 1.5–3.2 × 0.5–0.8 cm, acuminate; rachis 3.8–12 cm; *floral bracts* ovate-lanceolate to lanceolate, shorter or equaling the pedicellate ovary, 10–25 × 2.5–7 mm, decreasing in size toward the inflorescence apex, acuminate. *Flowers* 4 to 10, resupinate, glabrous, green to greenish yellow; pedicellate ovary spreading from the rachis, 14–20(–25) mm, ovary slightly arched, 12–18 mm, pedicel 3–6 mm; *sepals* green, margin slightly verrucose toward the apex; dorsal sepal deeply concave, rounded when flattened, 4–5.8 × 4–5.2 mm, apex somewhat truncate; lateral sepals spreading, concave, obliquely elliptic when flattened, 7–8.8 × 3.5–4.7 mm, base twisted, adaxial side turned downward, upper margin revolute, mucro subapical, dorsal; *petals* slightly bipartite, green; posterior lobe oblong, 4–5 × 1.5–1.8 mm, apex truncate, obscure to distinctly apiculate; anterior lobe reduced to a tooth-like projection, inserted at the base of the posterior segment, 1–1.8 × 0.9–1.4 mm, oblong, apex rounded; *lip* distinctly tripartite, white or whitened at the base, green toward the apex of the lobes; undivided basal part short, 1–1.5 × 2–2.5 mm; lateral lobes spread, perpendicular to the midlobe, linear, slightly curved upward, 9–11 × 0.7–1(–1.3) mm, occasionally with a subapical tooth, acute; midlobe turned downward, linear, slightly curved backward, 9–11 × 1.2–1.3 mm, apex truncate; *spur* green, pendent, free from the bracts, slightly curved, slightly clavate, equaling the pedicellate ovary, 15–20 mm long, base ca. 0.8 mm wide, apex 1.2–1.5 mm wide; *column* erect, 3.5–4 mm high; connective emarginate, green; auricles fleshy, verrucose, flat, ca.

1 mm; anthers ca. 2 mm, canals 2–3 mm; *hemipollinaria* 2, separated, each ca. 5 mm long; viscidium ca. 0.3 × 0.3 mm, spaced ca. 2 mm apart; caudicles 3.5–4 mm; pollinia 4, ca. 1.2 × 0.5 mm; stigmas 2, 2.5–3 mm, green, receptive surface convex, turned frontward, closely parallel, forming a single receptive surface, receptive part 1–1.5 mm, apex ca. 1 mm wide each, truncate; rostellum ca. 4.5 mm, green; midlobe triangular, fleshy, obtuse, completely placed between the anthers, ca. 1.5 mm long, ca. 1 mm high; side lobes parallel throughout, ca. 3.5 mm. *Fruit* not examined.

Distribution. *Habenaria pseudoglaucophylla* is so far known only from single collections from six localities in the state of Minas Gerais: Serra do Cabral, Serra da Piedade, Serra do Caraça, Serro, Serra Negra, and Morro do Chapéu.

Habitat, ecology, and phenology. *Habenaria pseudoglaucophylla* occurs from 1200 to 1600 m, in campo rupestre vegetation, usually associated with large quartzite outcrops and growing in the vicinity of small shrubs. This is a very distinctive habitat not typically occupied by other *Habenaria* species and very different from the open wet fields where *Habenaria* species abound. In the four collections made by the authors, no other *Habenaria* species were observed as sympatric at the collection sites. However, it can also be found in wet moss and in cliff bases; in the Serra da Piedade and Morro do Chapéu, the taxon was also collected in steep, rocky, iron-rich slopes (Fig. 2). Plant growth is associated with the availability of water during the rainy season, and flowering occurs from the peak to near the end of the rainy season, from January to April.

IUCN Red List category. According to the current knowledge of the species and using IUCN Red List Categories and Criteria (IUCN, 2001), *Habenaria pseudoglaucophylla* can tentatively be classified as Endangered (EN B2b(iii); D). It is unlikely that the species will suffer any significant collection pressure at any time, but loss of habitat is a real threat. Just two of the known locations are in conservation areas (Serra do Cabral and Serra do Caraça), and only one is effectively protected (Serra do Caraça). At Serra Negra only a few individuals were observed in an area intensely visited by tourists. The other population sizes are estimated to number less than 50 individuals. Three of the known populations of the species are still located in remote areas, but this can easily change with the ever-increasing human occupation or use of these areas.

Etymology. The new species epithet refers to the fertile and vegetative morphological similarity with *Habenaria glaucophylla*.

Discussion. As far as we could determine, *Habenaria pseudoglaucophylla* was first collected by H. S. Irwin in 1970 in Serra do Cabral. At that time the species was examined by G. F. J. Pabst, who identified some of the collections as *H. glaucophylla* and *H. umbraticola* Barbosa Rodrigues. In fact, the three species are similar in habit, with basal leaves, but differ in reproductive characters (Table 1). *Habenaria pseudoglaucophylla* is distinct from these and other similar species, such as *H. nemorosa* Barbosa Rodrigues and *H. piraquarensis* Hoehne, by its slightly larger flowers, green corolla (vs. white in *H. glaucophylla*), lateral sepals larger than the dorsal sepal (vs. subequal in size in *H. glaucophylla*, *H. umbraticola*, *H. nemorosa*, and *H. piraquarensis*), oblong posterior petal segment with a truncate apex (vs. linear-falcate with an acute apex in *H. glaucophylla*, *H. umbraticola*, *H. nemorosa*, and *H. piraquarensis*), and lip midlobe larger and with a truncate apex (vs. smaller and with an acute apex in *H. glaucophylla*, *H. umbraticola*, *H. nemorosa*, and *H. piraquarensis*). Additionally, *H. pseudoglaucophylla* inhabits campo rupestre vegetation associated with quartzite outcrops, while the other species typically inhabit the interior of semideciduous or humid forests.

The combination of rosulate leaves, deeply tripartite lip, oblong posterior petal lobe with a truncate apex, and a short, tooth-like anterior petal lobe are unique for *Habenaria pseudoglaucophylla* among New World *Habenaria*. According to the infrageneric treatments for the genus, *H. pseudoglaucophylla* should be placed in section *Quadratae* Kraenzlin (Kraenzlin, 1892, 1901) or *Microstylinae* Kraenzlin (Cogniaux, 1893). However, the exact infrageneric affiliation and classification of the new species are unclear. As stated, in vegetative characters *H. pseudoglaucophylla* is similar to a group of species characterized by the basal leaves, such as *H. glaucophylla*, *H. umbraticola*, and *H. piraquarensis*, while in the morphology of the petals and column structure it is similar to *H. curvilabria* Barbosa Rodrigues, *H. pleiophylla* Hoehne & Schlechter, and other species in the affinity of *H. odontopetala* Reichenbach f. and *H. floribunda* Lindley (Table 1). Future cladistic studies using both molecular and morphological characters may clarify the affinities of *H. pseudoglaucophylla* with these and other similar species.

Paratypes. BRAZIL. **Minas Gerais:** 8 km W of Joaquim Felicio, Serra do Cabral, 1200 m, 7 Mar. 1970, *H. S. Irwin, S. F. da Fonsêca, R. Souza, R. Reis dos Santos & J. Ramos 27101* (HB, RB, UB); Serra da Piedade, 35 km E of Belo Horizonte, near BR-31, 1800 m, 18 Jan. 1971, *H. S. Irwin, R. M. Harley & E. Onishi 28681* (NY, UB); Serro, Milho Verde, Serra do Ouro, 1 Feb. 2003, *R. C. Mota 1732* (BHCB); Rio

Table 1. Diagnostic characters for *Habenaria pseudoglaucophylla* and morphologically similar species.

	H. pseudoglaucophylla	*H. glaucophylla*	*H. umbraticola*	*H. pleiophylla*	*H. curvilabria*	*H. odontopetala*[b]
Stem (cm)[a]	16–33	22–31	22–37	(50)70–124	30–66	25–100
Leaves	basal, rosulate	basal, rosulate	basal, not rosulate	basal to scattered	scattered	scattered
Dimensions (cm)	2.1–8.3 × (0.7)1.7–3.5	6–15 × (1.6)3–5	4.5–9 × 0.8–2.1	8–22 × 1.4–2.6(4)	7–13 × 1.3–2.5	7–20 × 2–5
Flowers	4 to 10	7 to 11	3 to 9	up to 70	12 to 40	up to 60
Corolla	green	white	green	green	green	green
Dorsal sepal (mm)	4–5.8 × 4–5.2	4–5.5 × (2.5)4–5	ca. 4 × 2.5	5–6 × ca. 6	3.5–5 × 3–5	4–7 × 4–5
Lateral sepals	twisted	not twisted	twisted	twisted	twisted	not twisted
Posterior petal lobe	oblong	linear-falcate	linear-falcate	oblong	oblong	oblong
Length (mm)	4–5	4–5.5	3.5–4	(3)3.5–4.5(5)	2.5–3	3–5
Apex	truncate	acute	acute	truncate	truncate	truncate
Lip	tripartite	tripartite	tripartite	tripartite	simple	simple
Lateral lobes (mm)	9–11	6–10	3–4	2–4	–	–
Midlobe (mm)	9–11	5.5–8	4.5–5	(6.5)8–10	6.5–9	6–12
Apex	truncate	acute	acute	obtuse	obtuse	obtuse
Habitat and distribution	campo rupestre, Brazil	forests, Brazil	forests, Brazil	forests, mangrove (restinga), secondary vegetation (capoeira) and fields, Brazil	forests, Brazil	forests, Brazil and northern South America, Central America, Mexico, the Antilles, and Florida, U.S.A.

[a] Including the inflorescence.
[b] Based on Correl (1950) and Luer (1975).

Preto, Serra Negra, trilha para a Gruta do Funil, 17 Apr. 2006, *N. L. Abreu, L. Menini Neto & O. J. Bastos Neto 73* (CESJ); Nova Lima, Morro do Chapéu, ca. 18 km S de Belo Horizonte, 29 Feb. 2007, *J. A. N. Batista 1967* (BHCB).

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Neotypification of *Agropyron deweyi* (Poaceae, Triticeae)

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ABSTRACT. As part of a revision of the genus, *Agropyron deweyi* Á. Löve (Poaceae, Triticeae) is neotypified, because its holotype grown from seed material from Turkey was lost. The neotype is selected from one of two specimens bearing the same wild-origin seed details as the original type, which differ in the date of their collection.

Key words: *Agropyron*, Poaceae, Triticeae.

The genus *Agropyron* Gaertner according to Löve (1984) contains one haplome, designated as P, and consists of taxa that are diploids, autotetraploids, and autohexaploids with genomes PP, PPPP, and PPPPPP, respectively. Tzvelev (1976) recognized 10 species in the genus, whereas Löve (1984) recognized three based on the three ploidy levels: *A. pectiniforme* Roemer & Schultes ($2n = 14$), *A. cristatum* (L.) Gaertner ($2n = 28$), and *A. deweyi* Á. Löve ($2n = 42$).

Löve (1984: 432) described *Agropyron deweyi* from a specimen "Grown from seeds from 32 miles east of Van, Turkey, on a rocky slope at 2100 feet, collected on August 27, 1948, by J. R. Harlan, U.S. Department of Agriculture, Introduction Service, No. PI 173622, CS-3-87, cultivated at Evans Farm, Cache County, Utah, U.S.A., specimen collected on June 28, 1979, by Douglas R. Dewey. Type in UTC, Logan, Utah, U.S.A." An extensive search for the type by the curator of UTC failed to reveal this type, and it is therefore considered to be lost. It is also worth noting that the tetraploid *A. cristatum* cannot be distinguished in outward appearance from the hexaploid *A. deweyi*. After the curator was asked to search for hexaploid specimens, two specimens labeled "*A. cristatum*" and annotated "$2n = 42$" with almost the same label as the one quoted by Löve were found; however, these specimens have a collection date of 30 June 1982 (vs. the protologue date 28 June 1979) and different CS numbers (CS-2-31 and CS-3-44), and the collectors are C. Nowak & D. R. Dewey (vs. Dewey). There is thus a strong possibility that the holotype was lost. The search by the curator also uncovered five specimens annotated in print by Dewey "$2n = 42$" and also labeled "*A. cristatum*" by Dewey, who considered these specimens including the type by Löve to be no more than chromosomal variants of the tetraploid *A. cristatum* (see below under Selected specimens).

Although these were collected prior to the publication of *Agropyron deweyi*, they were not cited by Löve in the protologue, and there is no evidence that he ever saw them (Löve was working from his home in California by 1983). Consequently, we do not consider these eligible as lectotype specimens according to the *International Code of Botanical Nomenclature* (McNeill et al., 2006), and hence neotypification is necessary. The obvious choice of neotype is one of two specimens with identical collection number (PI 173622) to the type indicated by Löve but collected in June 1982.

Agropyron deweyi Á. Löve, Feddes Repert. 95: 432. 1984. *Agropyron cristatum* (L.) Gaertner subsp. *incanum* (Nábělek) Melderis, Notes Roy. Bot. Gard. Edinburgh 42: 77. 1984. *Agropyron incanum* (Nábělek) Tzvelev, Bot. Zhurn. (Moscow & Leningrad) 78: 88. 1993. TYPE: [Turkey (Love, 1984).] Grown at Evans Farm, Utah State Univ. USDA-ARS Grass Plots, Cache Co., Utah, 30 June 1982, *PI 173622, CS-2-31*; *C. Nowak & D. R. Dewey s.n.* (neotype, designated here, UTC 176336; duplicate of neotype, UTC 179536). Figure 1.

Distribution. *Agropyron deweyi* is found in eastern Turkey and western Iran.

Selected specimens. "Grown at Paradise Farm, Utah State University USDA-ARS Grass Plots. Cache County, Utah," all collected on 5 July 1983 by T.

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Figure 1. Photograph of the neotype of *Agropyron deweyi* Á. Löve (UTC 176336).

Stockton & D. R. Dewey. Their collection numbers differ: "PI 401083; PE-5-41"; "PI 401084; PE-5-51"; "PI 401085; PE-5-62"; "PI 380621; PE-15-21"; and "PI 406442; PE-7-23." The first four originated from seed material collected in Iran and the fifth from the former U.S.S.R. A search in GRIN (Germplasm Resources Information Network at the United States Department of Agriculture, Agricultural Research Service, Beltsville, Maryland, U.S.A., <http://www.ars-grin.gov/>) revealed that the first three originated

from seed material collected in "Bazargan, at the Iran–Turkey border on a dry hillside just inside Iran. Elevation: 1600 meters" by Dewey. The fourth is from seed material collected by Schwendiman in "Mako, near Iran–Turkey border. Limestone hillside," and the fifth was received from the collection of the N. I. Vavilov Institute of Plant Industry, now St. Petersburg, Russia.

Acknowledgments. We are grateful to Mary Barkworth (UTC) for the search and loan of *Agropyron cristatum* specimens bearing in their labels "$2n = 42$." The authors are grateful to the Program for Changjiang Scholars and Innovative Research Team in University (PCSIRT), China (No. IRT 0453) for financial support. We thank Scott Redhead (Agriculture and Agri-Food Canada, Ottawa) for beneficial comments on a draft of the manuscript and John McNeill for critical comments and suggestions.

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Neotypification of *Roegneria caucasica*, the Type of *Roegneria* (Poaceae, Triticeae)

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Abstract. As part of a taxonomic revision of the genus *Roegneria* K. Koch (Poaceae, Triticeae), a neotype is designated for *R. caucasica* K. Koch, the type of the generic name, because the entire type collection of Koch's specimens in Berlin (B) was destroyed during World War II.

Key words: Poaceae, *Roegneria*, Triticeae.

This paper results from the authors' revision of the genus *Roegneria* K. Koch (Poaceae, Triticeae). Most of the approximately 120 species of *Roegneria* were recently incorporated into a much larger genus, *Elymus* L. (Löve, 1984). The justification for the recognition of *Roegneria* as a genus separate and different from *Elymus* and related genera was demonstrated by morphological and numerical taxonomy (Baum et al., 1991, 1995) and on a cytogenetic basis (Jensen & Wang, 1991; Lu, 1993).

The genus *Roegneria* was published by K. Koch in August 1848 (Moore & Wood, 1965), with a single species, *R. caucasica* K. Koch. Koch traveled in the Caucasus and Central Asia in 1837–1838 and in 1843–1844. Koch's private herbarium was incorporated into the Berlin herbarium (B), in 1913 (Ulbrich, 1917). Koch's types, including that of *R. caucasica*, were destroyed in March 1943 during World War II. Unsuccessful inquiries were made to G, GOET, H, LE, MEL, MO, P, and W to locate specimens from the type gathering of *R. caucasica* based on Edmonson and Lack (1977). We thus engaged in a search for a neotype for *R. caucasica*.

Two alternatives were considered from the area of Daghestan near Kuba, where Koch's type was collected "Im Waldern Daghestans, besonders der Herrschafft Kuba ziemlich haüfig: 500–1000′ hoch auf Kalk" (translation from the German: In woods of Daghestan, especially near Kuba, where it is abundant 500–1000 feet alt. on limestone). First, we found a collection made by Th. Alexeenko (Θ. Алексъенко) in 1898 from Daghestan (northern Caucasus, southwestern Russia), in approximately the same locality as that of the type. We examined duplicates of the collection in BM and K, but we were unable to check the specimen(s) in TB where the main Alexeenko collection is kept.

A second candidate for neotype was a collection of specimens of historical importance collected by Regel. This is the collection of *Agropyron raegnerii* Boissier (Boissier, 1884) examined by its author. This name is a synonym of *Roegneria caucasica* based on Boissier's examination of Koch's specimen (Boissier, 1884: 662). Koch's specimen was at the time in his own private collection. Boissier, contrary to the present *International Code of Botanical Nomenclature*, adopted the new epithet *raegnerii* for the species in *Agropyron*, even though the epithet *caucasicum* was then available in *Agropyron*, and thus created an illegitimate name because it was nomenclaturally superfluous when published (Art. 52, McNeill et al., 2006). Boissier based *A. raegnerii* not just on Koch's specimen of *R. caucasica*, but also on the type gathering of *Triticum strigosum* var. *microcalyx* Regel extant in duplicates in G-BOISS (the location of the specimen on which the illegitimate *A. raegnerii* [not shown] was based), as well as in K (Fig. 1), LE, P, and other herbaria.

Regel's collection is designated here as type for *Roegneria caucasica* with the neotype specimen in LE, whereas the duplicates at K (Fig. 1) and P are isoneotypes. Because the type of *Roegneria* is necessarily *R. caucasica* (the only species included by Koch when he described the genus), the neotype specimen of *R. caucasica* is also the neotype of the generic name *Roegneria*.

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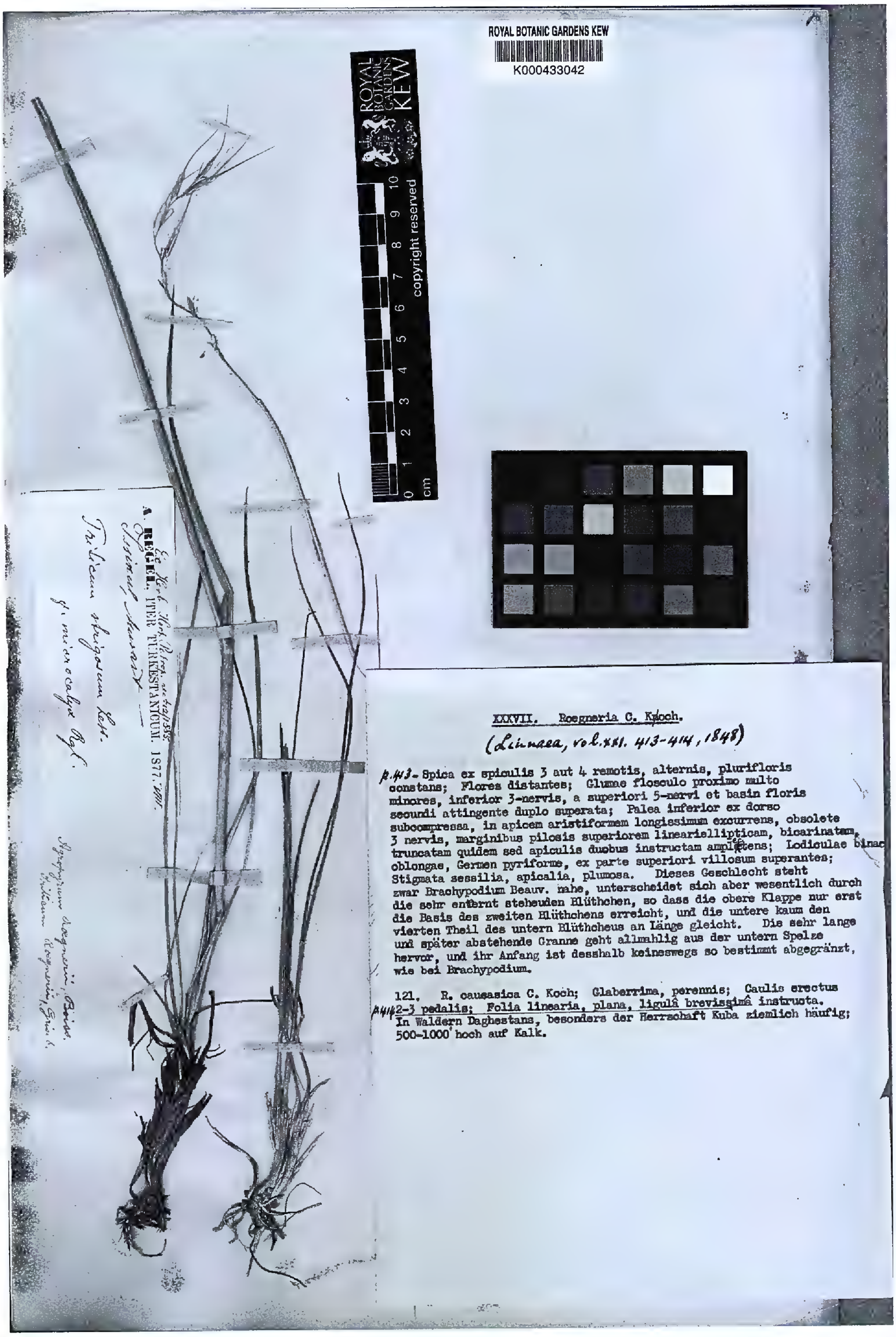

Figure 1. Isoneotype of *Roegneria caucasica* K. Koch (K000433042). Reproduced with the kind permission of the Trustees of the Royal Botanic Gardens, Kew.

Roegneria K. Koch, Linnaea 21: 413. 1848. *Agropyron raegnerii* Boissier, Fl. Orient. 5: 662. 1884. TYPE: *R. caucasica* K. Koch.

Roegneria caucasica K. Koch, Linnaea 21: 413. 1848. TYPE: Turkestan. "A. Regel Iter Turkestanicum Aug. 1877 VIII. Tssikul, Musast. *Triticum strigosum* Less. v. *microcalyx* Rgl.," *A. Regel s.n.* (neotype, designated here, LE not seen; duplicate of neotype, K000433042 photo). Figure 1.

Acknowledgments. We are grateful to Simon Owens, then Keeper of the Herbarium, Royal Botanic Gardens, Kew, for sending us photographs of the isoneotype and for granting us permission to publish it. We thank John McNeill, Edinburgh, United Kingdom, for valuable suggestions and comments.

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A New Threatened Species of Pandanaceae from Northwestern Madagascar, *Pandanus sermolliana*

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ABSTRACT. *Pandanus sermolliana* Callmander & Buerki (Pandanaceae) is described from humid forests in the Galoka mountain chain in northwestern Madagascar. The new species can be easily distinguished from the other members of the genus it most closely resembles, *P. insuetus* Huynh and *P. perrieri* Martelli, by several morphological characters, including drupes that are incompletely fused, with each of the dome-like carpels separated from the base of the pileus, and stigmas that are subvertical or rarely subhorizontal, slightly spinescent, and raised on an incompletely united base. This distinctive species is rare and is classified as Critically Endangered based on IUCN Red List criteria.

RESUME. Une nouvelle espèce *Pandanus sermolliana* Callmander & Buerki (Pandanaceae) est décrite provenant des montagnes du Galoka dans les forêts denses humides du Nord Ouest de Madagascar. La nouvelle espèce peut être facilement différenciée des espèces affines, *P. insuetus* Huynh et *P. perrieri* Martelli, par ses caractères morphologiques incluant ses drupes à carpelles incomplètement soudés dès la base du piléus en forme de dôme et ses stigmates subverticaux, rarement sub-horizontaux, légèrement spinescents, surélevés sur une base incomplètement soudée. Cette espèce rare et unique est sérieusement menacée. Elle est considérée comme Critiquement en Danger selon les Critères de l'UICN.

Key words: IUCN Red List, Madagascar, Pandanaceae, *Pandanus*.

The Paleotropical genus *Pandanus* Parkinson comprises some 600 species of trees and shrubs divided in 10 subgenera and 59 sections (Stone, 1974; Callmander & Laivao, 2003). Madagascar is one of the major centers of diversity of the genus with ca. 90 species, all except one of which belong to subgenus *Vinsonia* (Warburg) B. C. Stone. Only *P. perrieri* Martelli, described on the basis of fragmentary material, has been placed in subgenus *Pandanus* sect. *Pandanus*.

Over the past 10 years, in preparation for a treatment of Pandanaceae for the *Flore de Madagascar et des Comores*, we have collected more than 200 specimens from all of Madagascar's phytogeographic regions as well as from the surrounding islands. We have also examined herbarium specimens from all of the major herbaria with significant holdings of the genus from Madagascar, viz. those in Antananarivo (TAN, TEF), Florence (FI), Geneva (G), Neuchâtel (NEU), Paris (P), and St. Louis (MO), and have published a series of taxonomic revisions and notes on the group (Laivao et al., 2000, 2006, 2007; Callmander et al., 2001, 2003a, b, c; Callmander & Laivao, 2002). These studies provided the basis for assessing the conservation status of all Malagasy Pandanaceae following the IUCN Red List criteria (IUCN, 2001) and for identifying priority areas for conserving members of the family (Callmander et al., 2007).

During the past three years, we have conducted an intensive botanical inventory of a poorly known portion of Madagascar's northern mountains, situated between the Marojejy and Tsaratanana massifs, aimed at improving our understanding of the region's biogeography (Guillaumet et al., 2008) and providing conservation recommendations of these biologically important, highly threatened forests. As part of this study, we visited the southern part of the Galoka

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massif, including the Kalabenono hills, a poorly explored mountain chain situated at the northern edge of the Sambirano region in northwestern Madagascar. Our fieldwork in this area, which has thus far generated more than 500 collections, clearly indicates that the massif contains many new species, including taxa in the following families: Anacardiaceae (Randrianasolo & Lowry, in press), Annonaceae, Burseraceae, Euphorbiaceae, Malvaceae, Oleaceae, and Violaceae. Among our many discoveries, we also collected a remarkable new species of Pandanaceae, which we describe here.

Pandanus sermolliana Callmander & Buerki, sp. nov. TYPE: Madagascar. Prov. Antsiranana: Chaîne Galoka, Mont Galoka, Fokontany Anketrabe-Belinta, lisière de forêt dense humide, 13°35′3.3″S, 048°43′29.6″E, 820 m, 5 Feb. 2005, *M. W. Callmander, S. Buerki & S. Wohlhauser 367* (holotype, MO; isotypes, G, P, PH, TAN). Figure 1.

Haec species quoad drupas incomplete connatas ad *Pandanum perrieri* Martelli maxime accedit, sed ab eo druparum quoque carpello tholiformi ex pilei base separato atque stigmatibus subverticalibus (raro subhorizontalibus) parum spinescentibus super basem incomplete unitam elevatis distinguitur.

Tree to 5–6 m tall, stem prickly, 7–8 cm diam., erect, branched; prop roots present. Leaves gradually attenuate in the distal part, 210–240 × 4.5–5 cm in the middle, 5.5–6 cm near the sheath, apex attenuate; leaves coriaceous when dry; auricles lacking, blade densely alveolate on abaxial surface, longitudinal and transverse veins visible on both surfaces; prickles brownish; marginal prickles beginning at 15–17 cm above the base and extending to the apex, antrorse, ca. 4 mm in the lower 1/3, 3–8 mm apart, strong, to 2 mm in the middle 1/3, 12–18 mm apart, to 1 mm in the distal 1/3, 3(–6) mm apart; midrib armed, prickles small (< 0.5 mm), randomly disposed (2–7 cm apart) and slightly prominent, antrorse in the upper 1/2, then larger (0.5–1 mm), regularly disposed, spaced (3–6 mm apart) and prominent; sheath 16–17 cm long, 6 cm wide at apex, 8–9 cm at base. Infructescence terminal, the solitary syncarp erect on a straight peduncle; syncarp 15–16 × 13–14 cm, subspherical; core ca. 3 × 2 cm; peduncle 17–21 cm long, 2–2.5 cm wide at apex, 1.5–1.8 cm in the middle, straight, trigonous, veins visible, first bract borne ca. 7 cm from the base of syncarp, 6 to 7 bracts on entire peduncle. Drupes 12 to 18, connate in the mature syncarp, 60–75 mm high, 50–70 mm wide, 35–55 mm thick, 4(to 5)-angled; pileus convex, distal 1/3(–1/2) free; carpels (1 to)5(to 7), incompletely united, each carpel with a dome-like apex; apical sinuses 2–5 mm deep, V-shaped; stigmas (1 to)5(to 7), 3–4 mm high; somewhat spinescent, subvertical, rarely subhorizontal, raised on an incompletely united base, laterally disposed on the margin of a slightly concave plateau; endocarp 20–25 mm long in the center, shortened on both sides, 40–65 mm wide, ca. 10 mm away from the stigmas; seed locule oblong, ca. 15 × 7 mm, superior mesocarp narrow and compact; inferior mesocarp thick and fibrous. Male flowers unknown.

Distribution and habitat. Our new species is only known from the Kalabenono-Galoka massif in northwestern Madagascar, in montane forest at an elevation of ca. 500–800 m.

IUCN Red List category. *Pandanus sermolliana* has an area of occupancy of 18 km², and comprises two known subpopulations, neither of which is located in a protected area. Using the methodology of Callmander et al. (2007) based on the IUCN Red List criteria (2001), we therefore assigned a preliminary status of Critically Endangered (CR A3c; C2a(i); D).

Etymology. This species is named in honor of Rodolfo E. G. Pichi-Sermolli (1912–2005), who published many works on tropical African phytogeography and taxonomy and made an important contribution to our understanding of Malagasy Pandanaceae. When one of the most influential specialists of the family, Ugolino Martelli, died in 1934, he left behind a manuscript based on the collections made by Henri Perrier de la Bâthie in Madagascar, which Pichi-Sermolli brought to completion and published in 1951 (Martelli & Pichi-Sermolli, 1951). Several decades later, Stone (1975) published *Pandanus pichi-sermollii* B. C. Stone in his honor, but that species was recently placed in synonymy under *P. guillaumetii* B. C. Stone (Laivao et al., 2007). Here, we once again honor Pichi-Sermolli by describing *P. sermolliana*.

Observations. *Pandanus sermolliana* is remarkable in having an infructescence and drupes that are among the largest known on Madagascar, comparable only with those of *P. insuetus* and *P. perrieri*. Our new species can, however, be geographically separated from *P. insuetus*, which is endemic to lowland forests of the Masoala peninsula (ca. 280 km to the east). *Pandanus sermolliana* also differs morphologically from *P. insuetus* in having no prominent auricles at the base of its leaves (vs. large auricle ca. 17 × 14 cm in *P. insuetus*) and stigmas laterally disposed on the margin of a slightly concave plateau on each carpel of the drupe (vs. gathered in a circle at the apex of the drupe 6–10 mm apart from another in *P. insuetus*) (Laivao et al., 2006). Morphologically, *P. sermolliana*

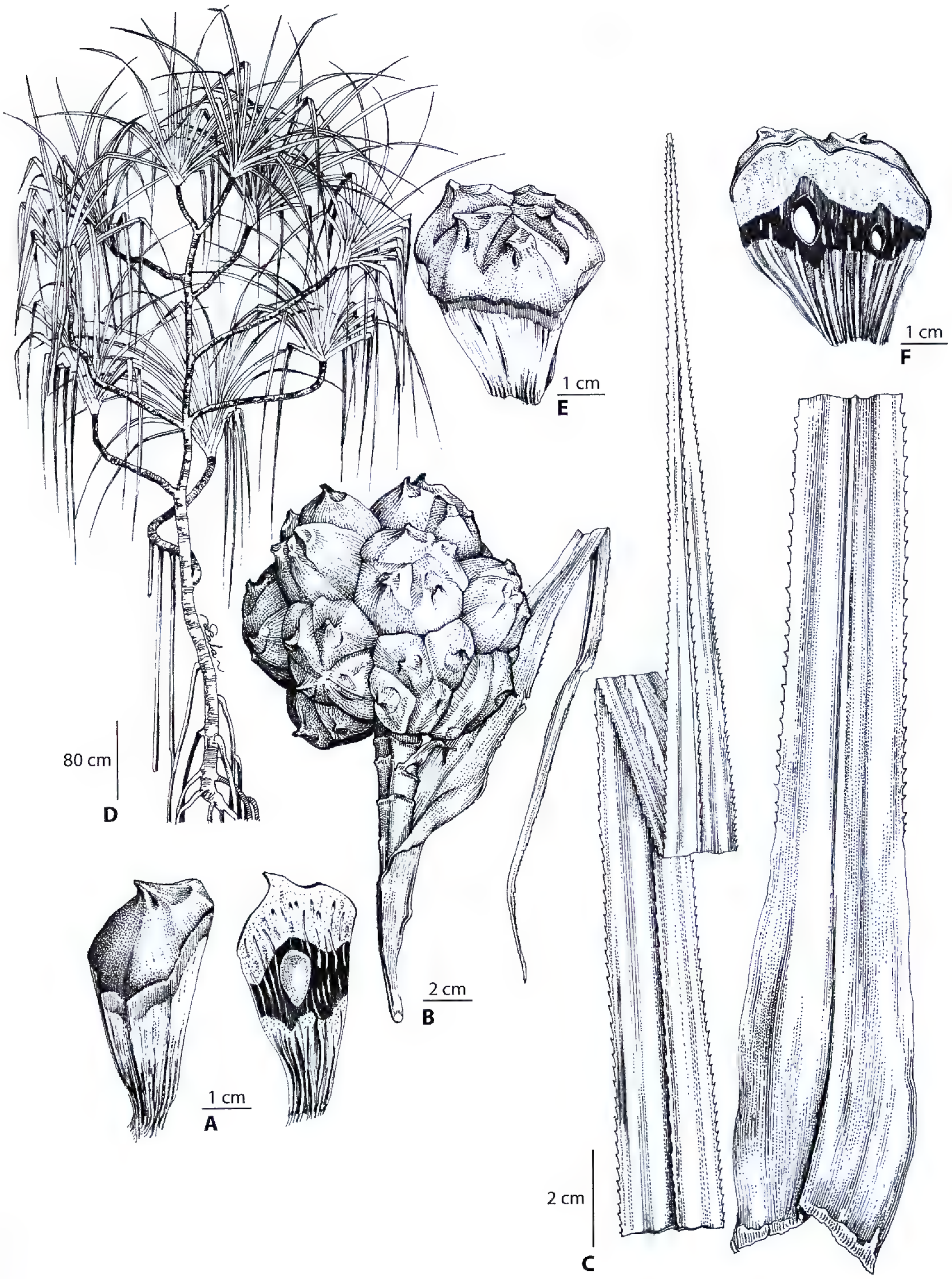

Figure 1. *Pandanus sermolliana* Callmander & Buerki. —A. Lateral view and longitudinal section of a monoloculate drupe. —B. Syncarp. —C. Apex and base of a leaf. —D. Habit. —E. Lateral view of a pluricarpellate drupe showing the stigmas. —F. Longitudinal section of a pluriloculate drupe. Drawn from the holotype, *Callmander et al. 367* (MO).

closely resembles *P. perrieri*, with which it shares incompletely fused drupes and leaves that lack large auricles. Our new species can, however, be distinguished from *P. perrieri* by having drupes that are incompletely fused, with each of the dome-like carpels separated from the base of the pileus (vs. flat and fused in the distal 1/3 of the pileus in *P. perrieri*), and stigmas that are subvertical or rarely subhor-

izontal, only slightly spinescent, and raised on an incompletely merged base (vs. subhorizontal or rarely subvertical, flat to deltoid, and not raised in *P. perrieri*).

Paratypes. MADAGASCAR. **Prov. Antsiranana:** Ambilobe, Beramanja, Anketrabe, forêt de Kalabenono, haut de crête, sol profond, 690 m, 13°38′36″S, 48°40′25″E, 25 Nov. 2006, *M. W. Callmander, Jo Vasaha & Malaza 596* (G, MO, P, TAN); Ambilobe, Beramanja, Anketrabe, versant Nord-ouest du Kalabenono, 520 m, 13°38′38″S, 48°40′07″E, 26 Nov. 2007, *C. Rakotovao, M. W. Callmander, Jo Vasaha & Torze 3803* (G. K, MO, P, TAN).

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A New Species of *Malaxis* (Orchidaceae, Epidendroideae, Malaxideae) from the Venezuelan Andes

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ABSTRACT. A new species of *Malaxis* Solander ex Swartz (Orchidaceae, Epidendroideae, Malaxideae), *M. medinae* Carnevali & Noguera Savelli, from Trujillo State in Andean Venezuela is proposed herein. The new taxon is related to the widespread *M. soulei* L. O. Williams, a species found from the southwestern United States southward into Panama. The plants, however, are smaller (to only 12.7 cm) and have proportionally longer peduncles (to 4.5 cm) that bear fewer flowers (12 to 25 per spike) with a much more triangular labellum with parallel apical teeth (vs. convergent in *M. soulei*).

RESUMEN. Una nueva especie de *Malaxis* Solander ex Swartz (Orchidaceae, Epidendroideae, Malaxideae), *M. medinae* Carnevali & Noguera Savelli, del estado Trujillo en los Andes venezolanos, es propuesta en este artículo. El nuevo taxón está relacionado cercanamente con la ampliamente distribuida *M. soulei* L. O. Williams, conocida desde el suroeste de los Estados Unidos hasta Panamá. Las plantas de *M. medinae* son más pequeñas (solo hasta 12.7 cm) con pedúnculos proporcionalmente más largos (hasta 4.5 cm) y con menos flores (12 a 25 por espiga) con un labelo más triangular con dientes apicales paralelos (vs. convergentes en *M. soulei*).

Key words: Andes, IUCN Red List, *Malaxis*, Monumento Nacional Tetas de Niquitao y Guirigay, Orchidaceae, Venezuela.

The genus *Malaxis* Solander ex Swartz (Orchidaceae, Malaxideae) is cosmopolitan, with ca. 300 species. Most species occur in the tropics of both the Old and New World, with fewer in subtropical and temperate regions (Foldats, 1970; Cribb, 2005). As currently circumscribed, the genus is most likely polyphyletic (Cameron, 2005; Cribb, 2005). For the purposes of this paper, however, its former, broader circumscription is retained. In the New World, *Malaxis* consists of several easily distinguishable groups, based mostly on vegetative and inflorescence characters, since the flowers are remarkably consistent in structure. In a few species, the flowers are sessile (i.e., the inflorescence is a spike) like in *M. myurus* (Lindley) Kuntze and *M. streptopetala* (B. L. Robinson & Greenman) Ames, but in most taxa the flowers are clearly pedicellate. Inflorescences with pedicellate flowers can be racemose when the rachis is elongate (as in *M. johniana* (Schlechter) Foldats and related taxa), or subumbellate when the rachis is abbreviated and the flowers more or less successive (as in *M. andicola* (Ridley) Kuntze). Leaves range from one to three (rarely more) per stem. Most South American *Malaxis*, including Venezuelan taxa, belong to a group of taxa with two leaves and subumbellate inflorescences, which includes such taxa as *M. excavata* (Lindley) Kuntze and its related species, as well as *M. histionantha* (Link, Klotzsch & Otto) Garay & Dunsterville and its relatives.

In Venezuela, the genus *Malaxis* is represented by 13 to 15 species, of which five or six are apparently endemic (Carnevali & Ramírez-Morillo, 2003; Carnevali & Noguera Savelli, unpublished). *Malaxis* are most diverse in the Andean areas, where most of the Venezuelan taxa are represented. During the study of *Malaxis* from South America, we assessed the status of an unusual *Malaxis* previously reported as *M. soulei* L. O. Williams, characterized by small plants with a single leaf and elongate, spicate inflorescences. This entity is herein proposed as a new species.

Malaxis medinae Carnevali & Noguera-Savelli, sp. nov. TYPE: Venezuela. Trujillo: Guirigay hacia

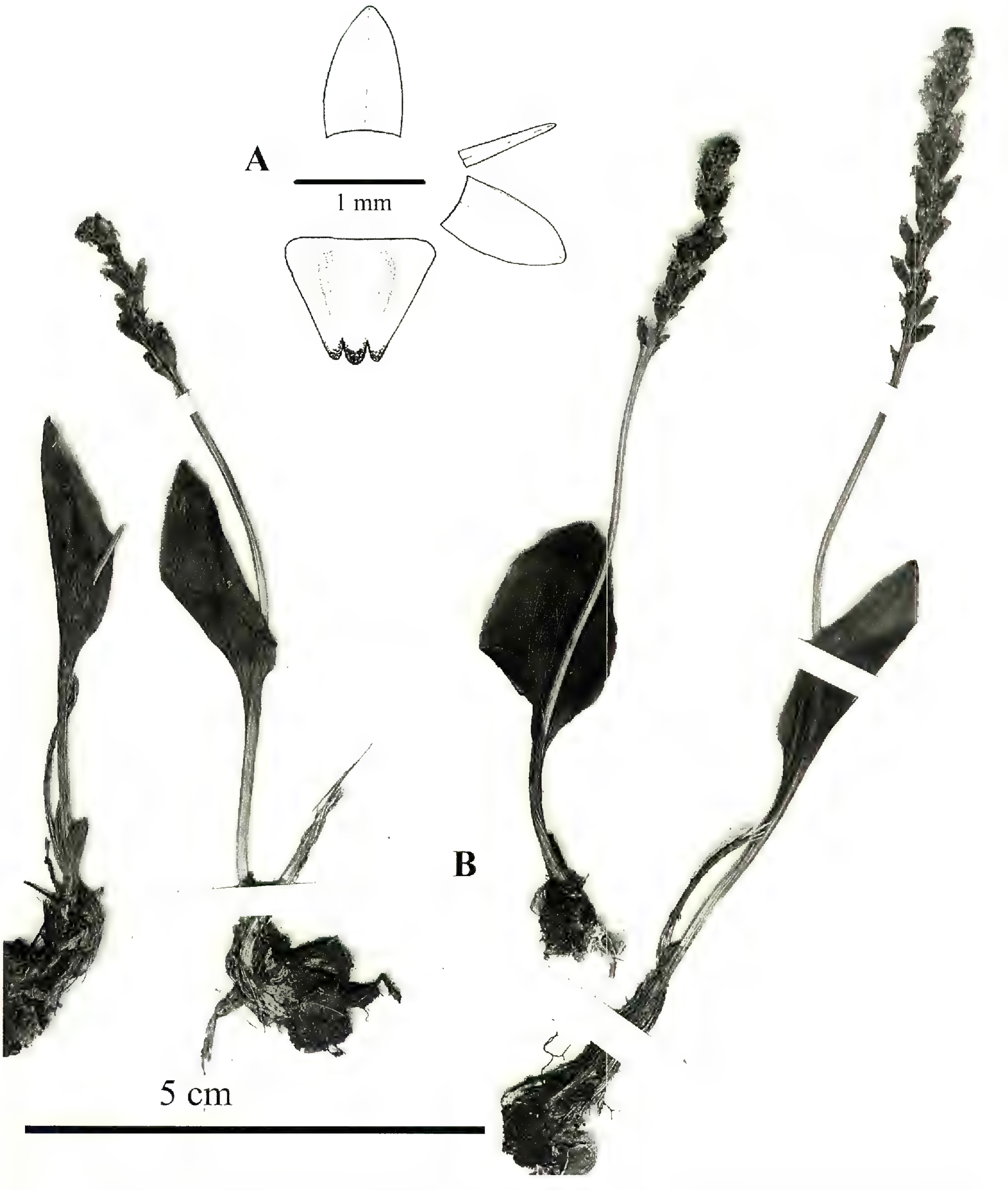

Figure 1. *Malaxis medinae* Carnevali & Noguera Savelli. —A. Floral segments, spread. —B. Flowering habit. Both images from the holotype, *L. Aristeguieta & E. Medina 3583* (VEN).

Laguna La Parida (Laguna Las Parías), 3400 m, ago. 1958, *L. Aristeguieta & E. Medina 3583* (holotype, VEN; isotypes, CICY, MO). Figure 1.

Haec species *Malaxi soulei* L. O. Williams affinis sed ab ea foliis lamina ovata usque ovato-elliptica (vs. elliptica vel ovato-elliptica), inflorescentia proportione longiore pedunculo quam foliis multo longiore (vs. breviore vel subaequali) rachidi pedunculum subaequante vel paulo excedente (vs. quam eo multo breviore), floribus minoribus paucioribus atque labello proportione angustiore apice acutiore, dente centrali quam lateralibus longiore (vs. breviore) recedit.

Terrestrial, erect herbs 8.7–12.7 cm tall; rhizome not known but most likely short; *stems* thickened into a basally globose pseudobulb, ca. 3 mm thick, apically attenuated, enclosed by a single sheath 1.1–1.7 cm; *leaf* 1 per pseudobulb, basal, the blade

ca. 3 × 1.2 cm, membranous, ovate to ovate-elliptic, margin entire, apex acute to broadly acute, base cuneate to obtuse, narrowed into a sheathing petiole 3–4.5 cm around the basal half of peduncle. *Inflorescence* terminal, a 12- to 25-flowered spike, peduncle 3.3–4.5 cm, channeled and slightly compressed, somewhat winged in the apical 1/3; rachis 1.8–2.7 mm, winged, the wing membranous, to 0.8–1 mm wide; floral bracts ca. 1 × 0.8–1 mm, deltoid, apex rounded; *flowers* ca. 2.5 mm, yellowish green, not resupinate, perianth segments spreading widely, almost sessile, ovary ca. 0.5 mm; sepals elliptic, acute to broadly acute, 1-nerved, dorsal sepals ca. 1.5 × 0.6 mm, lateral sepals ca. 1.5 × 1 mm; petals ca. 1.1 × 0.1–0.25 mm, linear or narrowly triangular-oblong, curved in natural position, 1-nerved; labellum ca. 1.5 × 1.5 mm, fleshier than the other perianth segments, concave, triangular-ovate, margin entire, apex deeply 3-dentate, the teeth verruculose, especially the central one, base truncate to slightly cordate; *column* ca. 0.5 mm, stout, subcylindrical; anther ca. 0.25 mm, terminal, 2-locular, pollinia 4, hard; capsule 2.5–3 mm, ellipsoid.

Distribution and habitat. The type locality of the new species is a small lake, Laguna Las Parías, which is located on the slopes of Cerro Guirigay (ca. 9°00′N, 70°33′W, 3400 m), along the way from the top of the mountain to Las Mesitas and then into Valera, a city to the northwest of the Cerro Guirigay. Although not mentioned by the collectors of the new species, the plants were most likely collected among páramo vegetation with Espeletiinae (Frailejones) such as *Espeletia tenorae* Aristeguieta.

IUCN Red List category. *Malaxis medinae* should be considered Critically Endangered (CR B2a) according to IUCN Red List criteria (IUCN, 2001) because it is known from a single, isolated locality of less than 10 km². Furthermore, *M. medinae* has not been re-collected since the original gathering in 1958. We have little further information about the conservation status of *M. medinae*. However, it is most likely a scarce species, or at least very inconspicuous and overlooked by collectors. Theoretically, it is well protected within the boundaries of the Monumento Nacional Tetas de Niquitao y Guirigay, which is relatively inaccessible. The species is most likely not threatened by overcollection due to its small size and the inconspicuousness of the flowers. However, páramo vegetation is subject to frequent fires, and since population sizes for the species are apparently reduced and it is known from a single locality of less than 10 km², there are grounds to suspect the species to be Critically Endangered.

Etymology. We take great pride in naming this new species after Ernesto Medina (1938–), from the Instituto Venezolano de Investigaciones Científicas (IVIC). Dr. Medina was one of the collectors of the type material. He has made important contributions to the knowledge of Venezuelan orchids through his collections and his research on the ecology and ecophysiology of epiphytes, most importantly by means of his interest in the evolution of photosynthetic pathways, particularly of the crassulacean acid metabolism (CAM) photosynthetic mechanism.

Discussion. *Malaxis medinae* is the second known South American species of a complex of North American and Mexican *Malaxis* with spicate inflorescences on 1-leaved pseudobulbs, the other being *M. carnosa* (Kunth) C. Schweinfurth, which is known from Peru. *Malaxis carnosa* has a transversely round-oval to reniform labellum with a single, relatively large median apicule or lobule that is oblong-ovate to ovate and subacute to rounded at the apex (Schweinfurth, 1959).

Malaxis medinae is closest to *M. soulei*, but *M. soulei* is a larger plant (17–25 cm tall), with larger (sepals 2–2.2 mm) and more numerous flowers (> 50 per spike), with proportionally shorter peduncles that are always shorter than the subtending leaves. Furthermore, the shape of the labella of these closely related species is different. In *M. medinae* the central tooth is longer or subequal to the laterals (vs. shorter in *M. soulei*), while the lateral teeth are parallel to the central one as opposed to the always convergent lateral teeth of *M. soulei*. While in *M. soulei* the general outline of the labellum is somewhat ovate-triangular, the labellum of the new species is definitely triangular and pointed at the apex. In *M. soulei* there is a more or less conspicuous rounded lobe at each side of the base, while these lobes are absent in *M. medinae*, hence the labellum base is truncate.

This novelty was reported as *Malaxis soulei* by Foldats (1970: 442, 443) from Venezuela based on the only collection known. *Malaxis soulei* ranges from New Mexico, Arizona, and Texas in the U.S.A. (Catling & Magrath, 2002), into the high mountains of central Mexico, and down into Chiriquí in Panama. *Malaxis medinae* is disjunct from the nearest populations of *M. soulei* by more than 1300 km in a straight line. No populations similar to either species are known from either the western or the central cordillera of the Andes. The only known locality of *M. medinae* is on the northeastern section of the Cordillera de Mérida, which is in turn an offshoot of the Eastern Cordillera of the Andes. In Cameron's recent (2005) phylogenetic analysis of the Malaxi-

deae, *M. soulei* resides in the same clade as *M. spicata* Swartz, which is the type of the genus. Thus, both our new species and *M. soulei* will most likely remain members of *Malaxis* even if generic circumscriptions in the Malaxideae are redefined.

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New Species of *Philodendron* (Araceae) from Bajo Calima, Colombia

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ABSTRACT. Twenty new species of *Philodendron* Schott (Araceae) from Bajo Calima, Colombia, are described as new: *P. baudoense* Croat & D. C. Bay, *P. canicaule* Croat & D. C. Bay, *P. chrysocarpum* Croat & D. C. Bay, *P. coriaceum* Croat & D. C. Bay, *P. discretivenium* Croat & D. C. Bay, *P. dryanderae* Croat & D. C. Bay, *P. furcatum* Croat, *P. heterocraspedon* Croat & D. C. Bay, *P. hiberisiccans* Croat & D. C. Bay, *P. monsalveae* Croat & D. C. Bay, *P. ninoanum* Croat & D. C. Bay, *P. oblanceolatum* Croat & D. C. Bay, *P. polliciforme* Croat & D. C. Bay, *P. rhodospathiphyllum* Croat & D. C. Bay, *P. rubromaculatum* Croat & D. C. Bay, *P. striatum* Croat & D. C. Bay, *P. suberosum* Croat & D. C. Bay, *P. tricostatum* Croat & D. C. Bay, *P. trojitense* Croat & D. C. Bay, and *P. venulosum* Croat & D. C. Bay.

RESUMEN. Viente nuevas especies del *Philodendron* Schott (Araceae) de Bajo Calima, Colombia, se describen como nuevas: *P. baudoense* Croat & D. C. Bay, *P. canicaule* Croat & D. C. Bay, *P. chrysocarpum* Croat & D. C. Bay, *P. coriaceum* Croat & D. C. Bay, *P. discretivenium* Croat & D. C. Bay, *P. dryanderae* Croat & D. C. Bay, *P. furcatum* Croat & D. C. Bay, *P. heterocraspedon* Croat & D. C. Bay, *P. hiberisiccans* Croat & D. C. Bay, *P. monsalveae* Croat & D. C. Bay, *P. ninoanum* Croat & D. C. Bay, *P. oblanceolatum* Croat & D. C. Bay, *P. polliciforme* Croat & D. C. Bay, *P. rhodospathiphyllum* Croat & D. C. Bay, *P. rubromaculatum* Croat & D. C. Bay, *P. striatum* Croat & D. C. Bay, *P. suberosum* Croat & D. C. Bay, *P. tricostatum* Croat & D. C. Bay, *P. trojitense* Croat & D. C. Bay y *P. venulosum* Croat & D. C. Bay.

Key words: Araceae, Bajo Calima, Colombia, IUCN Red List, *Philodendron*.

This paper treats 20 new species of *Philodendron* Schott (Araceae) from Bajo Calima, Colombia. The aim is to succinctly publish these new species of *Philodendron* in preparation for a more thorough treatment in an entire flora of the Bajo Calima region, complete with thorough descriptions, keys, and illustrations. The Bajo Calima region, which covers roughly 80,000 ha. of lowland tropical rainforest and is located on the Pacific Andean slopes in central Colombia, is known to be one of the centers of diversity for Araceae. The majority of these (13) are members of section *Macrobelium* (Schott) Sakuragui, while six are members of section *Philodendron* Schott. These two sections are the most common in the genus, which currently comprises nine sections. The only other sections known from Central America are section *Tritomophyllum* (Schott) Engler and section *Macrogynium* Engler. The other sections, *Baursia* (Reichenbach ex Schott) Engler, *Philopsammos* G. S. Bunting, *Schizophyllum* (Schott) Engler, *Polytomium* (Schott) Engler, and *Camptogynium* K. Krause in Engler, are all restricted to South America. As is evident from the numbers of new species from this one small region alone, there remain many undescribed species of *Philodendron* in the Andean portions of South America, so collectors should bear this in mind while collecting.

1. **Philodendron baudoense** Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Bajo Calima region, Km 17.5, 6.5 km NW of Pulpapel facility, 130 m, 11 July 1993, *T. B. Croat & D. C. Bay 75645* (holotype, MO-04575188; isotypes, B, COL, CUVC, K, US).

Planta hemiepiphytica aut terrestris; internodia 3–16 cm longa, 6–20 mm diam., in sicco canoviridia; cataphylla 6–

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15 cm longa, acute 2-costata, decidua intacta. Folia patentia vel reflexo-patentia; petiolus adaxialiter obtuse complanatus, 5.5–14(–23) cm longus, 5–8 mm diam. in sicco; lamina elliptica usque obovata, subcordata, 25–43.5 cm longa, 7–14 cm lata. Inflorescentia solitaria; pedunculus 1.5–8 cm longus; spatha 7–18 cm longa. Pistilla ca. 2.4 mm longa; ovarium 5- vel 6-loculare, loculis 1-ovulatis.

Hemiepiphytic or terrestrial; stem appressed-climbing or scandent; *internodes* matte to weakly glossy, 3–16 cm × 6–20 mm, longer than broad, medium green to gray to light brown, drying gray-green, epidermis light tan, loose and cracking, drying with epidermis flaking off exposing olive-green stem underneath; roots several per node, drying reddish brown, epidermis flaky; *cataphylls* 6–15 cm, sharply 2-ribbed, rounded at apex, soft, medium green, drying light tan to medium olive-green, deciduous. LEAVES spreading to reflexed-spreading; *petioles* 5.5–14(–23) cm × 5–8 mm (dry), obtusely flattened adaxially, broadly rounded abaxially, medium green, moderately spongy, dark green-lineate, drying medium olive-green; *blades* obovate to elliptic, subcoriaceous, acuminate at apex, subcordate at base, 25–43.5(–66) × 7–14(–24) cm, (2.7–)3–4.1× longer than wide, (1.9–)3.6–5.8(–7.8)× longer than petiole, broadest at or beyond middle, adaxial surface semiglossy, medium green to yellow-green, drying dull medium to dark olive-green, abaxial surface matte, paler, drying dull and paler; anterior lobe 25–42(–64) × 7–14(–24) cm, 7.8–25(–58)× longer than posterior lobe; posterior lobe 7–40 mm × 1.2–5 cm, rounded; sinus V-shaped to hippocrepiform, 4–26 mm deep; *midrib* broadly convex at base becoming narrowly convex at apex and paler than blade, narrowly rounded abaxially, drying darker than blade on both surfaces; basal veins 3 pairs per side, all free to base, drying lighter than blade adaxially, darker than blade abaxially; *primary lateral veins* 5 to 13 per side, 3–5 cm apart, departing midrib at 40°–50° angles, sharply downturned at midrib, curving upward to margins, drying lighter than blade adaxially, darker than blade abaxially; interprimary veins departing from the primary lateral veins near the base but otherwise mostly from the midrib, drying concolorous adaxially, darker than blade abaxially; minor veins obscurely visible. INFLORESCENCE erect, solitary; *peduncle* 1.5–8 cm, shorter than petiole, medium green, drying dark olive-green; *spathe* 7–18 cm, barely constricted; spathe blade 6–8 cm, outside white, inside pale green with orange resin canals in upper 2/3; spathe tube 5–7 cm, pale to light green, outside minutely speckled, inside red-violet to dark burgundy in basal 1/3; *spadix* cylindrical, 9–12 cm; pistillate portion 2.5–4.5 cm × 5–10 mm (dry); staminate portion slightly clavate, 6.5–8 cm × 8–10 mm at widest point (dry); sterile staminate portion 8–15 × 5–7 mm (dry), narrower than pistillate or fertile staminate portion; *pistils* ca. 2.4 mm; ovary 5- to 6-locular, ovules with basal placentation, 1 per locule; sterile staminate flowers unknown. INFRUCTESCENCE unknown. JUVENILE PLANTS differ in having a deeply sulcate petiole and blades rounded or barely cordulate, drying pale green.

Distribution and habitat. *Philodendron baudoense* is endemic to Colombia and is known from the western slopes of the Cordillera Occidental in the departments of Chocó and Valle. It occurs in Tropical wet forest (T-wf) and Tropical rain forest transition to Premontane (T-rf/P) life zones (Holdridge et al., 1971), ranging from sea level to 920 m, in primary forest, older regrowth forest, or growing on steep rocky road banks.

IUCN Red List category. Conservation for *Philodendron baudoense* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), since it is known from many collections and has been found in both Chocó and Valle departments.

Phenology. It was collected in flower in February, March, and July, and adult plants in sterile condition in February, March, and April.

Etymology. *Philodendron baudoense* is named for the Serranía de Baudó, a low mountain range in the department of Chocó, and one of the first collection sites for this species.

Discussion. The species is a member of subgenus *Philodendron*, section *Macrobelium* (Schott) Sakuragui, subsection *Glossophyllum* (Schott) Croat, series *Glossophyllum* and is characterized by its scandent habit, long gray-green internodes that dry with a very flaky pale epidermis, and sharply 2-ribbed deciduous cataphylls. It also has leaf blades that are usually elliptic to obovate and subcordate, with a midrib that is much broader at the base and narrows toward the apex. The primary lateral veins are distinctive because they are widely spaced and curve upward quickly. The inflorescence is solitary, barely constricted, pale green at the base, and white at the apex.

Philodendron baudoense can be confused with *P. ligulatum* Schott (ranging along the Atlantic slopes from Nicaragua to Panama to the Colombian departments of Antioquia and Chocó), which differs in having fewer primary lateral veins that depart from the midrib at more obtuse angles, the blades drying dark green, and the inflorescences drying blackened.

Another similar species is *Philodendron pseudoauriculatum* Croat, found in Panama and northern Colombia. That species differs, however, in having shorter internodes with a darker tan epidermis that is

not as flaky. In addition, it bears two to three inflorescences per axil (as compared to solitary inflorescences in *P. baudoense*) on peduncles generally longer than 8 cm.

Paratypes. COLOMBIA. **Chocó:** Serranía de Baudó, Quibdó–Las Animas rd., 25 km NW of Las Animas, *Croat 56021* (COL, JAUM, MO); Quebrada Antón, along Pueblo Rico–Istmina rd., 15 km W of Santa Cecilia, *Croat 70950* (MO); Bolívar–Quibdó rd., Km 137–138, *Croat 57353* (MO); Río Atrato, Tagachi, 40–50 m, 8 Apr. 1982, *Forero et al. 8998* (COL). **Valle:** Km 42–43, *Croat & Watt 70294* (COL, K, MO, NY); near Río Calima, in oil palm grove, *Croat 57523* (MO); Quebrada La Sierpe, close to Palestina, *Forero et al. 3887* (MO); Bahia Málaga, vic. Base Naval Málaga, along rd. to Buenaventura, ca. 1 km from base ca. Km 104, *Croat & Gaskin 80455* (CUVC, MO); Río Bongito, *Croat & Gaskin 80536* (CUVC, MO).

Cultivated plant. COLOMBIA. **Valle:** Calima rd., cultivated at Wilson Botanical Garden, Costa Rica, vouchered 11 Jan. 1978 as *Croat 44435* (MO).

2. Philodendron canicaule Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Bajo Calima region, 4.5 km W of Km 28 on Buenaventura–Málaga rd., 50–80 m, 3 Aug. 1993, *D. C. Bay 251* (holotype, MO-04585213; isotypes, B, COL, CUVC, K, NY, US).

Planta hemiepiphytica aut raro terrestris; internodia 1.5–25 cm longa, 1–4 cm diam., canoviridia; cataphylla decidua intacta. Folia patentia; petiolus teres, 21–46 cm longus, 4–8 mm diam. in sicco; lamina ovata, profunde cordata basi, 26.5–56 cm longa, 16–32(–39) cm lata, nervis lateralibus primariis sicut basalibus utroque 4 ad 7. Inflorescentiae in quaque axilla 1 ad 3; pedunculus 5–12 cm longus; spatha 5–7.5 cm longa, lamina extus viridi-alba vel flavo-cremea, intus cremeo-flava, tubo extus virenti, intus rubro vel marronino. Pistilla ca. 0.8 × 0.8 mm; ovarium 4-loculare, loculis 1-ovulatis.

Hemiepiphytic or rarely terrestrial; stem appressed-climbing or scandent; sap pale orange to orange-brown; *internodes* long, weakly glossy, 1.5–25 × 1–4 cm, longer than broad, gray-green to green or light brown; epidermis scurfy, conspicuously transverse-fissured, drying yellowish tan and flaking; roots to 3 mm diam., few per node, drying dark reddish brown with loose epidermis; *cataphylls* 12–28 cm, unribbed, 1-ribbed, or sharply 2-ribbed, rounded and apiculate at apex, green or yellow-green, drying dark rusty brown, deciduous. LEAVES spreading; *petioles* 21–46 cm × 4–8 mm (dry), terete, sulcate toward base, slightly flattened and sometimes sulcate toward apex, medium green, matte, weakly striate, drying golden-tan, often longitudinally wrinkled; *blades* ovate, coriaceous to moderately coriaceous, short-acuminate at apex, deeply cordate at base, 26.5–56 × 16–32(–39) cm, 1.2–1.7× longer than wide, 0.8–1.3(–1.6)× as long as petiole, broadest near the middle, adaxial surface semi-glossy, dark green, drying glossy and olive-green to medium olive-tan, abaxial surface matte to weakly glossy, paler, drying slightly less glossy and barely paler than adaxially; anterior lobe 20–42 × 16–32(–39) cm, 1.9–3.1× longer than posterior lobe; posterior lobes 8.5–16 × 7.5–15 cm, usually rounded, sometimes slightly rectangular at apex; sinus parabolic to spatulate, 5–13 cm deep; *midrib* flat and paler adaxially, round-raised and paler abaxially; *primary lateral veins* 4 to 7 per side, 2–5 cm apart, departing midrib at 50°–60°, downturned at midrib then fairly straight but curving upward to within 1.5 cm of the margin; *basal veins* 4 to 7 pairs per side, 4 coalesced 1–3 cm, 2 coalesced up to 7 cm, posterior rib not naked or naked up to 3 cm, 1 vein free to base; interprimary veins obvious but less prominent than primary lateral veins; secondary veins distinct, fine, parallel to primary lateral veins. INFLORESCENCE small, erect, 1 to 3 per axil; *peduncle* 5–12 cm × 2–3 mm (dry), much shorter than petiole, pale to medium green sometimes tinged red, drying light reddish brown; *spathe* 5–7.5 cm, barely constricted, drying rusty reddish brown; spathe blade 3.5–4.5 cm, greenish white to yellowish cream outside, creamy yellow inside; spathe tube 2–3.5 cm, green outside, rosy red to maroon inside; *spadix* cylindrical, weakly exserted from the spathe, barely constricted near base of fertile staminate portion, 5.3–5.8 cm; pistillate portion pale green becoming white, 2–2.5 cm × 3–4 mm (dry); staminate portion creamy white, 3.2–3.7 cm × 3–5 mm (dry); sterile staminate portion ca. 1 cm, ca. 5 mm diam. (dry); *pistils* ca. 0.8 × 0.8 mm; ovary 4-locular, ovules with basal placentation, 1 per locule. INFRUCTESCENCE not seen.

Distribution and habitat. *Philodendron canicaule* is endemic to Colombia, known only from the western slopes of the Cordillera Occidental, Valle Department, within the Bajo Calima region, in an area of Tropical rain forest transition to Premontane (T-rf/P), below 150 m. It has been collected in dense primary forest, regrowth forest, and in deep ravines along streams.

IUCN Red List category. Conservation for *Philodendron canicaule* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the area of the type locality, it is not yet known from other sites in Colombia. It is possible that the species is more widespread than is currently known, because much of the Pacific slope is still poorly known.

Phenology. *Philodendron canicaule* has been collected flowering in February, July, August, and November, and as sterile adult plants in February, March, and July.

Discussion. The species is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Glossophyllum*, series *Ovata* Croat and is characterized by its weakly glossy, transversely fissured, gray-green stem with fairly long internodes, hence the epithet *canicaule* (from the Latin "canus" meaning grayish white and "caulis" meaning stem). Also distinctive are the long, variably ribbed, deciduous cataphylls, the terete petioles sulcate at the base, the cordate leaf blades that are matte abaxially with well-developed posterior ribs, and the small inflorescences.

Philodendron canicaule may be confused with *P. polliciforme* Croat & D. C. Bay because their leaf blades are similar in shape and both have small spathes (4.5–8.5 cm long). They differ, however, in that the latter species usually has shorter internodes, cataphylls that are quite red and have at least the basal portion persisting, leaf blades drying dull olive-green without any red color, and an inflorescence with a red spathe.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 9, *Croat 70107* (MO); Km 11, Pulpapel, *Croat 62785A* (MO), *69305* (CUVC), *69308* (CUVC, MO), *Monsalve 1219* (CUVC, MO); Km 18, *Croat 61339* (MO, MEXU, TEX, UB); Carretera Hanz, *Croat 71078* (MO); Km 33.3, *Croat 61281* (COL, CUVC, IMB, MO, SEL), *61383* (COL, MO), *61387* (HUA, MO); Km 44, *Croat & Watt 70192* (GH, MO, QCNE, USM), *70197* (COL, F, G, JAUM, K, MO, NY, VEN); Km 50.7, *Croat & Bay 75687* (CUVC, MO).

Cultivated plant. COLOMBIA. **Valle:** Calima rd., Calima–Buenaventura, 8°49′N, 82°58′W, 1200 m, cultivated at Wilson Botanical Garden, Costa Rica, vouchered 6–7 Mar. 1984 as *Croat 57269* (MO).

3. Philodendron chrysocarpum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Bajo Calima region, Buenaventura–Málaga rd., vic. of Km 50.7, less than 100 m, 12 July 1993, *T. B. Croat & D. C. Bay 75684* (holotype, MO-04572419; isotypes, B, CAS, COL, CUVC, F, K, MEXU, NY, PMA, QCNE, SEL, TEX, US, VEN).

Planta hemiepiphytica aut terrestris; internodia interdum obtuse costata, 0.4–4 cm longa, 0.5–3 cm lata, nitida; cataphylla 14–15.5 cm longa, acute 2-costata, decidua intacta. Folia erecta vel patentia; petiolus (5.3–)6.5–9.5 cm longus, 2–4 mm diam. in sicco, profunde sulcatus usque ad medium, cum annulo purpureo apice; lamina elliptica, 23.5–30 cm longa, 5–9 cm lata, nervis lateralibus primariis utroque plus quam 30, indistinctis. Inflorescentia solitaria; pedunculus 2–4 cm longus; spatha 12–19 cm longa, viridi-alba. Pistilla 6–11 mm diam.; ovarium 5-loculare, loculis 6- ad 8-ovulatis.

Usually hemiepiphytic, occasionally terrestrial; stem appressed-climbing or scandent; *internodes* sometimes bluntly ribbed, 0.4–4 × 0.5–3 cm, longer than wide, yellow-green to dark green, sometimes tinged purple, glossy, drying smooth, with some transverse fissures, olive-tan to red-brown to brown; roots few to several per node, highly branched, glossy, red-brown, drying smooth, red-brown to medium brown; *cataphylls* 14–15.5 cm, sharply 2–ribbed, long-tapered and acute at apex, medium green, tinged purple, drying reddish brown, deciduous while intact. LEAVES erect to spreading; *petioles* (5.3–)6.5–9.5 cm × 2–4 mm (dry), deeply sulcate so as to appear sheathed in lower 1/3–2/3, terete toward apex, obtusely flattened adaxially, medium green tinged purple or red toward apex, drying dark, red-brown to brown; geniculum marked with a narrow (1–2 mm) purple ring at the apex, drying dark brown; *blades* elliptic, subcoriaceous, acuminate at apex, attenuate at base, 23.5–30 × 5–9 cm, 3.4–4.8(–5.2)× longer than wide, 2.6–3.8× longer than petiole; adaxial surface moderately glossy, medium green, somewhat bicolorous, drying glossy, reddish green or reddish olive-green, abaxial surface glossy and paler than adaxially fresh and dried; *midrib* broadly raised and slightly paler than blade adaxially, bluntly acute to narrowly rounded and much paler than blade or purple abaxially; *primary lateral veins* more than 30 per side, departing midrib at 45°, obscure on both surfaces; all other veins obscure adaxially and abaxially. INFLORESCENCES erect, 1 per axil; *peduncle* 2–4 cm × 5–7 mm, shorter than petiole, yellowish green to dark green, drying dark red-brown; *spathe* long-tapered, outside dark yellow-green, striate toward base, inside greenish white with orange resin canals to within 2 cm of the apex, drying dark red-brown, only slightly constricted where the pistillate portion of the spadix ends, 12–19 cm long; spathe blade 6–9 cm; spathe tube 6.5–10; *spadix* cylindrical, 8–15.5 cm; pistillate portion green turning pale yellow at anthesis, 2–6 cm × 8–10 mm (dry); staminate portion white, 6.5–9.5 cm × 8–10 mm (dry); sterile staminate portion to 2.5 cm long, narrower than other regions at anthesis; pistils 6–11 mm diam., ovary 5-locular, ovules with basal placentation, 6 to 8 per locule; sterile staminate flowers unknown. INFRUCTESCENCE with pistillate spadix ca. 8 × 2 cm (dry), *berries* globular, bright golden yellow-orange with red stigmas.

Distribution and habitat. *Philodendron chrysocarpum* is endemic to Colombia and is known mostly from the western slopes of the Cordillera Occidental, Valle Department, within the Bajo Calima region, in an area of Tropical rain forest transition to Premontane (T-rf/P), below 150 m. One specimen (*Juncosa 2552*) was collected from Tropical wet forest (T-wf) in the department of Chocó, where it was found in disturbed forest at an elevation of 465 m. It has been collected in dense primary forest, regrowth forest, along roadsides, and growing in mangrove swamps.

IUCN Red List category. Conservation for *Philodendron chrysocarpum* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), since it is known from both Chocó and Valle departments and is common in the Bajo Calima area.

Phenology. *Philodendron chrysocarpum* has been collected flowering in March, June, and July, and in fruit in July. Sterile adult collections have been made in February and July.

Discussion. The species is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Macrobelium*, series *Macrobelium* and is characterized by its purple-tinged petioles that are sulcate in the lower 1/3 to 2/3, the narrow-elliptic blades, and midrib that is convex adaxially and often purple abaxially with other venation obscure. Also characteristic is the striated spathe that is green on both surfaces, and the golden yellow-orange fruit, hence the epithet *chrysocarpum* ("chryso" meaning golden and "carp" meaning fruit).

It is most easily confused with *Philodendron coriaceum* Croat & D. C. Bay, which also has elliptic blades with obscure veins, but a generally darker yellow-orange fruit. *Philodendron coriaceum* differs in having very coriaceous leaves 1.6–2.3(–2.6)× longer than broad, a flat midrib that is much paler adaxially and pale green abaxially, and a spathe tube that is red inside and usually also on the outside.

One specimen collected from Bay Estero de Bodegas on the south shore of Buenaventura Bay, *Killip & Cuatrecasas 38669* (CUVC, F, US), appears to be this species, but differs in having blades that are much wider (1.4–2.7× longer than wide), and truncate to slightly cordate at the base.

Paratypes. COLOMBIA. **Chocó:** Bolívar–Quibdo Hwy., Km 175–176, *Juncosa 2552* (MO). **Valle:** Buenaventura–Málaga rd., Km 11, *Croat 69300* (CUVC, MO), *Croat & Monsalve 61413* (COL, HUA, MO); Km 6.5, Carretera Hanz, *Croat 69484* (CUVC, MO), *71104* (MO); Km 44, *Croat & Watt 70237* (MO); Km 50.7, *Croat & Watt 70311* (G, JAUM, MO); Estero de Bodegas, S shore of Buenaventura, *Killip & Cuatrecasas 39215* (US, VALLE); Juanchaco Palmeras, *Gentry, Monsalve & Wolfe 47911* (CUVC); vic. of Bahia Málaga, Base Naval Málaga, Río Bongito, *Croat & J. F. Gaskin 80528* (CUVC, MO).

4. Philodendron coriaceum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Bajo Calima region, Buenaventura–Málaga rd., vic. of Km 50.7, less than 100 m, 12 July 1993, *T. B. Croat & D. C. Bay 75696* (holotype, MO-04575796; isotypes, B, COL, CUVC, F, K, NY, PMA, US).

Planta hemiepiphytica aut terrestris, scandens; internodia 1.5–13.5 cm longa, 4–8 mm diam.; cataphylla 15–18.5 cm longa, decidua intacta. Folia erecta; petiolus 6–11 cm longus, 3–5 mm diam. in sicco, D-formis vel late sulcatus; lamina ovata, coriacea, nervis lateralibus primariis utroque 13 ad 18 utroque. Inflorescentia solitaria; pedunculus 3–5 cm longus; spatha 10.4–18 cm longa, lamina utrinque pallide viridi, tubo extus virenti interdum suffuso roseo, intus rubroviolaceo. Pistilla ca. 8 × 7–10 mm; ovarium 6- ad 9-loculare, loculis 2- ad 3-ovulatis.

Hemiepiphytic or terrestrial, trailing over the ground; stems appressed-climbing or scandent; *internodes* semi-glossy, 1.5–13.5 cm × 4–8 mm, longer than broad, medium or dark green to purplish brown, drying golden to red or rusty brown with wrinkled, sometimes flaky epidermis; roots usually 2 per node, sometimes highly branching, red-brown; *cataphylls* 15–18.5 cm, unribbed or bluntly 2-ribbed, D-shaped in cross section with bluntly rounded apex, light green to yellowish green, often tinged red, drying pale reddish tan and wrinkled, deciduous. LEAVES erect; *petioles* 6–11 cm × 3–5 mm (dry), D-shaped to broadly sulcate, medium green, tinged red, semi-glossy, drying yellow-green, somewhat red with loose, wrinkled epidermis; *blades* ovate, thick and coriaceous, obtusely acuminate at the apex, obtuse at base, 12–21 × 5–12 cm, 1.6–2.3(–2.6)× longer than wide, (1.3–)2–2.5(–3.2)× longer than petiole; adaxial surface glossy, dark green, drying glossy, green or olive-green, abaxial surface paler, drying glossy and paler than adaxially; *midrib* flat and pale yellow-white adaxially, round-raised, paler than blade and tinged red abaxially; *primary lateral veins* etched adaxially, darker abaxially, 13 to 18 per side and very close together (ca. 1 cm apart), departing midrib at 30°–40° angles, drying concolorous and raised on both sides; cross veins numerous, minute, perpendicular, weakly etched adaxially, scarcely visible abaxially, drying concolorous and wrinkled on both sides. INFLORESCENCES erect, 1 per axil; *peduncle* 3–5 cm × 3–8 mm (dry), much shorter than petiole, green, drying reddish olive; *spathe* semiglossy, thin and long-tapered, 10.4–18 cm, drying red-brown; spathe blade pale green outside and inside; spathe tube medium green sometimes tinged rose outside, red-violet inside, with reddish orange resin canals inside tube; *spadix* long-tapered, white, 8–15.5 cm; pistillate portion 1.6–2.1 cm long on back, 2.3–6.5 cm long on front, 8–18 mm diam. (dry); staminate portion 5.7–9.7 cm × 6–10 mm from base to ca. 1 cm from apex where it begins to gradually taper (dry), narrower than pistillate portion, wider than sterile staminate portion; sterile staminate portion 0.5–1 cm × 5–7 mm throughout (dry), narrower than pistillate or fertile staminate portions; *pistils* ca. 8 × 7–10 mm, ovary 6- to 9-locular, ovules with subbasal placentation, 2 to 3 per locule. INFRUCTESCENCES with pistillate

spadix 8–9 cm, *berries* globular, yellow-orange with red-brown stigmas.

Distribution and habitat. *Philodendron coriaceum* is endemic to Colombia, known from the western slopes of the Cordillera Occidental from Tropical wet forest (T-wf) in the department of Chocó to Tropical rain forest transition to Premontane (T-rf/P) in the department of Valle, ranging in elevation from near sea level to 150 m. It is also known from Carchi and Esmeraldas provinces, Ecuador, in Tropical wet montane forest (TM-rf) from near sea level to 800 m of elevation. The new species has been collected growing in primary forest, regrowth forest, dense tidal forest, and montane wet forest.

IUCN Red List category. Conservation for *Philodendron coriaceum* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), since the species is widespread in Colombia and Ecuador.

Phenology. *Philodendron coriaceum* has been collected in flower in June and July and in fruit in September and November. Sterile adult collections have been made in February, July, and August.

Discussion. This species is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Macrobelium*. It would key to series *Ecordata* Croat, but may represent a new series because the blades lack etched minor veins on the adaxial surface. The species is characterized by its scandent habit; thick, ovate coriaceous blades (hence the epithet from the Latin "coriaceus") with a flat midrib much paler than the blade adaxially and often tinged red abaxially; and yellow-orange berries.

Philodendron coriaceum is most easily confused with *P. chrysocarpum*, which has elliptic leaves and yellow-orange berries. However, *P. chrysocarpum* differs in having subcoriaceous blades, 3.4–4.8(–5.2)× longer than broad (in contrast to 1.6–2.3(–2.6)× longer in *P. coriaceum*), a broadly raised midrib that is slightly paler adaxially and much paler or purple abaxially, and a yellowish green-striate spathe (in contrast to a spathe that is red-violet on the tube in *P. coriaceum*).

Paratypes. COLOMBIA. **Chocó:** Togoromá, *Killip & Cuatrecasas 39098* (COL, F, US, VALLE). **Valle:** Buenaventura–Málaga rd., Km 11, *Bay 271* (CUVC, MO), *Croat & Monsalve 61413A* (CUVC, MO), *Monsalve 415* (MO); vic. of Km 11 in front of Pulpapel headquarters, *Croat & Bay 75621* (MO); Km 44, *Croat & Watt 70209* (HUA, JAUM, MO), *70237A* (MO); Km 37, *Croat 69375* (CUVC). ECUADOR. **Carchi:** El Pailon, about 45 km from Maldonado, Maldonado–Tobar Donoso, *Madison & Besse 7136* (SEL). **Esmeraldas:** San Lorenzo Canton, Lita–San Lorenzo rd., 40.1 km W of Lita, *Croat 72325* (MO); 1.2 km W of El Durago, 21.1 km W of Alto Tambo, *Croat, Mansell, Hannon & Whitehill 82470* (MO, QCNE).

5. Philodendron discretivenium Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Old Buenaventura–Cali rd., 15 km S of Río Sabaletas, 340 m, 10 Feb. 1990, *T. B. Croat & J. Watt 70462* (holotype, MO-3790490; isotypes, B, COL, CUVC, K, NY, PMA, US).

Planta hemiepiphytica, raro terrestris; internodia 2–12 cm longa, 1–5.5 cm diam.; cataphylla usque ad 19 cm longa, ecostata, decidua praeter partem basalem. Folia patentia; petiolus 25–68.5 cm longus, 5–10 mm diam. in sicco, teres, leviter complanatus versus apicem; lamina ovata, profunde cordata basi, 27–64 cm longa, 23–53 cm lata, atroviridis supra, hebetata infra, nervis lateralibus primariis sicut basalibus utroque 4 ad 6, basalibus omnibus discretis usque ad costam. Inflorescentiae in quaque axilla 1 ad 4; pedunculus 5.5–9 cm longus; spatha 17–21 cm longa, lamina extus alba vel pallide viridi, dense suffusa rubroviolacea, purpurascenti margine, tubo extus viridi-albo vel roseo, intus intense rubro. Pistilla ca. 2 mm longa; ovarium 5-loculare, loculis 5- vel 6-ovulatis.

Hemiepiphytic, rarely terrestrial; stem appressed-climbing or scandent over the ground; *internodes* weakly glossy, white-streaked, 2–12 × 1–5.5 cm, usually longer than broad, medium to dark green becoming brown, drying pale tan on older portion to reddish brown on younger stem, epidermis somewhat transversely fissured, drying loosely wrinkled and flaky; roots reddish brown, few per node, to 4 mm thick; *cataphylls* to 19 cm, unribbed, rounded at apex, pale-lineate, medium to dark green, drying olive-green, deciduous except for mushy basal part. LEAVES spreading; *petioles* 25–68.5 cm × 5–10 mm (dry), terete, obtusely sulcate in lower 1/3, slightly flat toward apex, dark green, semi-glossy, finely pale streaked, drying dark olive-green to medium reddish brown to dark brown; geniculum 2–5 cm, 1–3 mm wider than petiole, drying darker than petiole; *blades* ovate, coriaceous to subcoriaceous, acuminate at apex, deeply cordate at base, rounded at margins, 27–64 × 23–53 cm, 1.1–1.5× longer than wide, 0.6–1.3× as long as petiole; adaxial surface semiglossy to glossy, dark green, drying dull medium to pale olive-green; abaxial surface matte, paler than adaxially, drying barely paler than adaxially, brownish olive-green; anterior lobe 26–47.5 × 23–53 cm, 2.5–3.3(–4.6)× longer than posterior lobe; posterior lobe 6–18.5 × 9.5–23.5 cm, rounded at apex; sinus arcuate to spatulate, 5–12 cm deep; *midrib* broadly convex, pale green adaxially, convex and darker abaxially; *primary lateral veins* 4 to 6 per side, 1.5–4 cm apart, none within 8–10 cm of apex, spreading from midrib at 40°–60° angles, gradually curving upward to margin, downturned at midrib, obtusely to

narrowly sunken adaxially, convex and darker than blade abaxially; *basal veins* 4 to 6 pairs per side, all free to midrib; interprimary veins all parallel, obscure adaxially, visible abaxially; minor veins obscure; veins all drying nearly concolorous with blade on both surfaces. INFLORESCENCE erect, 1 to 4 per axil; *peduncle* 5.5–9 cm × 7–10 mm (dry), much shorter than petiole, pale to medium green, finely striate, drying dark brown; *spathe* gradually tapering, rounded at apex, scarcely constricted above tube, 17–21 cm; spathe blade, outside white to greenish white, becoming heavily tinged red-violet, purple at margin, inside green to white at very tip of apex; spathe tube outside greenish white to pink, often finely white-streaked, inside suffused with burgundy or deep cherry-red to upper 3/4 inside, drying dark brown; *spadix* 13–18 cm; pistillate portion yellowish to creamy white, cylindrical, 5–8 cm × 8–18 mm (dry), narrower than staminate portion; staminate portion 7.5–10 cm, 10–16 mm diam. at widest point (dry), somewhat clavate; sterile staminate portion not apparent, *pistils* ca. 2 mm, ca. 1 mm diam. at base, tapering slightly to apex; ovary 5-locular, ovules with basal placentation, 5 to 6 per locule. INFRUCTESCENCE unknown. JUVENILE plants differ in having leaf blades barely cordate, and sinus (when present) to 8 mm deep.

Distribution and habitat. *Philodendron discretivenium* is endemic to Colombia and is known only from the western slopes of the Cordillera Occidental, Valle Department, in an area of Tropical rain forest transition to Premontane (T-rf/P), up to 340 m. The new species has been collected in dense primary forest, regrowth forest, and along roadsides.

IUCN Red List category. Conservation for *Philodendron discretivenium* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), since it is widespread on the Pacific slopes of Colombia.

Phenology. *Philodendron discretivenium* has been collected flowering in February and July. Sterile adult collections have been made in March and July.

Discussion. The species is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Macrobelium*, series *Macrobelium* and is characterized by its scandent habit, blades that are ovate and matte abaxially, and basal veins all completely free to the midrib, none of them coalesced, hence the epithet *discretivenium* ("discretus" meaning distinct and "vena" meaning vein). Also characteristic are the large, barely constricted inflorescences that have a distinctive pale greenish white spathe with purple margins.

Paratypes. COLOMBIA. **Chocó:** Quibdó–Medellin at Km 207.5, *Croat 52279* (MO). **Nariño:** La Planada, Tuquerres–Ricaurte, Reserva Nat. La Planada, 7 km above Chucunés, along trail to Pialapí, 150–200 m past entrance to La Planada Field Station, *Croat 70464* (COL, HUA, JAUM, MO, NY, VEN). **Valle:** Buenaventura–Málaga rd., Km 11, *Gentry, Juncosa & Mazuera 40295* (MO), *Croat 69326* (CUVC, MO), *Juncosa 2139* (CUVC, MO); Km 14, *Croat 57559* (MO); Km 33.3, *Croat 61274* (CUVC, MO); Km 35.2, *Croat & Bay 75739* (CUVC, MO); Km 50.7, *Croat & Bay 75702* (CUVC, MO); Km 65–66, *Croat 71052* (COL, F, HUA, JAUM, MO, NY, VEN); Bahia Málaga, vic. Base Naval Málaga, along rd. to Buenaventura, ca. 1 km from base, ca. Km 104, *Croat & Gaskin 80470* (CUVC, MO); along trail along the edge of the bay W of base headquarters, *Croat & Gaskin 80597* (CUVC, MO).

6. Philodendron dryanderae Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Bajo Calima region, Buenaventura–Málaga rd., Km 12.5, regrowth forest about 4 m tall, 4 Feb. 1990, *T. B. Croat 70137* (holotype, MO-3784814; isotypes, B, CAS, CM, COL, CUVC, F, HUA, K, M, MEXU, NY, PMA, QCNE, S, SEL, TEX, US, VEN).

Planta hemiepiphytica, scandens; internodia 3–9 cm longa, 4–50 mm diam.; cataphylla 13–18 cm longa, acute 1-costata, niveo-alba, decidua intacta. Folia patentia; petiolus 15–21 cm longus, teres; lamina ovata, cordata basi, 14.5–25 cm longa, 11–19 cm lata; nervis lateralibus primariis utroque 2 ad 4. Inflorescentiae in quaque axilla 3 ad 6; pedunculus 3.5–6.5 cm longus; spatha 4–5 cm longa, lamina extus alba vel flavido-alba, intus albida, tubo extus rubromarronino, intus albo. Pistilla ca. 0.6 mm diam.; ovarium 4- vel 5-loculare, loculis 1-ovulatis.

Hemiepiphytic; stem scandent; *internodes* 3–9 × 0.4–5 cm, longer than broad, green to olive to light brown, striate, epidermis with longitudinal ridges, flaking, drying yellowish tan, sap red; roots few per node, reddish brown; *cataphylls* 13–18 cm, sharply 1-ribbed, sometimes with a second weak rib, bright white, drying reddish brown, deciduous when intact. LEAVES spreading; *petioles* 15–21 cm × 3–5 mm (dry), terete, obtusely flattened adaxially, broadly sulcate at base for 2–4 cm, light to medium green, drying dark olive-green; geniculum ca. 1 cm, drying dark brown and shrivelled; *blades* ovate, coriaceous to subcoriaceous, slightly bicolorous, mucronate or sometimes acuminate at apex, cordate at base, 14.5–25 × 11–19 cm, 1.3–1.5× longer than wide, 0.9–1.2(–1.4)× longer than petiole, margins rounded, adaxial surface semiglossy, medium green, drying glossy dark olive-green, abaxial surface paler, drying glossy and paler; anterior lobe 11.5–19 × 11–19 cm, 2.4–2.7× longer than posterior lobe, broadest close to middle; posterior lobe 4.3–8 × 5–8.5 cm, rounded; sinus parabolic to spatulate, 3–5.5 cm deep; *midrib* broadly convex and paler than surface adaxially,

convex and paler than surface abaxially; *primary lateral veins* 2 to 4 per side, 2–3.8 cm apart, spreading from midrib at 60° angles, downturned at midrib, curving broadly out to margins, weakly sunken adaxially, weakly pleated-raised abaxially; *basal veins* 3 to 4 pairs per side, with 1 free to base, 2 to 3 coalesced to 2.5 cm, posterior rib naked to 1 cm; minor veins moderately obscure, arising from midrib. INFLORESCENCES 3 to 6 per axil; *peduncle* 3.5–6.5 cm × 3–6 mm (dry), shorter than petiole, light green, sometimes speckled with red, clearly demarcated from spathe; *spathe* 4–5 cm, semiglossy, constricted above tube; spathe blade 2–2.5 cm, outside white to yellow-white, inside white; spathe tube 2–3 cm, outside reddish maroon, inside white to cream; *spadix* protruding forward at anthesis, sessile, 3–4.8 cm; pistillate portion pale green, cylindrical to slightly clavate, 1.3–2 cm × 7–8 mm at widest point (dry); staminate portion oblong, creamy white, 2.3–3.2 cm long, narrower than pistillate portion; sterile staminate portion ca. 3 mm; *pistils* ca. 0.6 mm diam.; ovary 4- to 5-locular, ovules with basal placentation, 1 per locule. INFRUCTESCENCE unknown.

Distribution and habitat. *Philodendron dryanderae* is endemic to Colombia and is known only from the western slopes of the Cordillera Occidental, in the departments of Cauca, Chocó, and Valle, in areas of Tropical wet forest (T-wf), Tropical rain forest (T-rf), and Tropical rain forest transition to Premontane (T-rf/P). It occurs from sea level to 150 m, and has been collected in primary and regrowth forest, cloud forest, and along stream banks.

IUCN Red List category. Conservation for *Philodendron dryanderae* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), since it is widespread on the Pacific slope of Colombia and common in the Bajo Calima area.

Phenology. *Philodendron dryanderae* has been collected in flower in January, February, March, June, July, August, September, and October.

Etymology. *Philodendron dryanderae* is named in honor of Editha Ida Dryander, who made the earliest collection (1932) of this species that was examined.

Discussion. The species belongs to subgenus *Philodendron*, section *Macrobelium*, subsection *Macrobelium*, series *Macrobelium* and is distinguished by scandent stems with long internodes, bright snowy white cataphylls, terete petioles, and blades that are ovate and mucronate at the apex with few primary lateral veins. Also characteristic are the small inflorescences in axillary clusters that have spathes with reddish maroon tubes, and creamy white blades.

Another species occurring at Bajo Calima, *Philodendron hederaceum* (Jacquin) Schott, might easily be mistaken for *P. dryanderae*, especially when sterile. The former species differs in having a smooth stem epidermis, green cataphylls, a leaf blade margin that often becomes slightly concave toward the apex, and large (9–17 cm long), solitary, green inflorescences.

Philodendron dryanderae also could be confused with *P. purpureoviride* Engler, which has not been collected at Bajo Calima, but is known from the departments of Chocó and Nariño, Colombia. The latter species is similar in habit, blade shape, and venation, but differs in having cataphylls that are generally green and heavily tinged with maroon, and large (11–15 cm long), solitary inflorescences.

Another species that could be confused with *Philodendron dryanderae* is *P. sulcicaule* Croat & Grayum, although this species is known only from Costa Rica and Panama. It is similar to *P. dryanderae* in habit, stem characteristics, leaf blade shape, and small, clustered inflorescences. However, it differs in having green to pink cataphylls, a leaf blade that is more triangular than ovate, obscure primary lateral veins, and inflorescences with spathe tubes that are red or purple inside.

Paratypes. COLOMBIA. **Chocó:** on an island near Buenaventura, *Dryander 24* (MO); along the banks of the Río San Juan, Agua Negra–Palestina, *Cuatrecasas 21575* (F); Río Condoto–Río Iró, *Idrobo & Kyburz 1973* (COL); Quebrada Taparal, near Taparalito, *Forero et al. 4285* (COL); Quibdó–Tutunendo, Carmen de Atrato rd., *de Escobar et al. 2191* (HUA). **Valle:** Buenaventura–Málaga rd., Km 11, *Bay 227* (CUVC, MO), *Monsalve 1967, 3140* (CUVC, MO), *Croat 69298* (CUVC, MO); Km 11.5, *Croat & Gaskin 79779* (CUVC, MO); Km 14, *Croat 57553* (MO); Km 33.3, *Croat 61369A* (MO), *61370* (G, JAUM, MO); Km 27, Juanchaco Palmeras, *Gentry, Monsalve & Wolfe 47909* (CUVC, MO); Juanchaco Palmeras, *Bernardi 10649* (G, MO); San Isidro, camp Conifinderena, S sector, *Devia & Prado 2724* (TULV, US); N shore of Buenaventura Bay, *Killip & Cuatrecasas 38725* (F, US, VALLE); along old Cali–Buenaventura rd., near Sabaletas, *Croat 38573* (MO); at Km 18.5 across rd. from Finca Santa Elena, *Croat 38506* (MO); at Km 20.5 beyond summit of rd. W of Dias y Ocho, *Croat 38552* (COL); Río Cajambre, Guapecito, *Cuatrecasas 17687* (F, US).

7. **Philodendron furcatum** Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Bajo Calima region, vic. of Bahía Málaga, Base Naval Málaga, Río Bongito, 40 m, 04°00′44″N, 77°20′04″W, 29 July 1997, *T. B. Croat & J. F. Gaskin 80526* (holotype, MO-04940447; isotypes, B, COL, F, G, GH, HUA, JAUM, K, NY, US, VEN).

Planta terrestris, scandens; internodia brevia; cataphylla usque ad 10 cm longa, ecostatata, in fibras pallidas fatiscentia. Folia erecta; petiolus 43.5–55 cm longus, teres; lamina ovata vel triangulari-ovata, 32.5–48 cm longa, 16–27 cm lata, nervis primariis lateralibus utroque 5 vel 7,

atroviridibus. Inflorescentiaa in quaque axilla 1 ad 2; pedunculus 6–7 cm longus; spatha 12.5–13 cm longa, 2.1–2.3 cm lata, tubo viridi, lamina alba; spadix 11.5–12 cm longus, parte staminata 6–6.5 cm longa, 1.3–1.4 cm diam., parte pistillata 4–5 cm longa, 1.4–1.6 cm diam. Pistilla 1.8–2 mm longa; ovarium 5- vel 6-loculare, loculis 8- ad 10-ovulatis.

Terrestrial; stem scandent; *internodes* short, 2–2.5(–6) cm wide; *cataphylls* to 10 cm, unribbed, pale green to greenish white, promptly weathering to pale disorganized or semi-organized fibers with pieces of epidermis attached, drying as pale fibers with reddish brown epidermis, weakly persisting at upper nodes. LEAVES erect; *petioles* 43.5–55 cm long, 3–8 mm diam., terete, matte, flattened adaxially toward apex, with a narrow, weak, medial sulcus, medium to dark green, sparsely short-streaked, drying medium olive-green; *blades* ovate to triangular-ovate, moderately thin, bullate-quilted, drying chartaceous, markedly bicolorous, narrowly long-acuminate at apex, deeply sagittate at base, 32.5–48 × 16–27 cm, (1.6–)1.7–2× longer than wide, 0.7–0.8× as long as the petiole, broadest near the middle or at petiole attachment, sometimes weakly constricted at or about the petiole attachment; margins somewhat undulate; adaxial surface semiglossy, dark green, drying dull olive-green to grayish with the major veins usually drying much darker; abaxial surface paler than adaxially and matte, drying pale olive-green; anterior lobe 22.5–33 × 16–27 cm, 1.7–1.8× longer than posterior lobes; posterior lobes 12.5–18 × (6.3–)8–11.5 cm, narrowly rounded at apex, directed downward and outward; sinus hippocrepiform, 10–11.5 cm deep; major veins drying raised, concolorous with surface but with very dark margins adaxially, round-raised and darker than surface abaxially; *midrib* darker than surface, flat or slightly raised within deep valleys, marginally dark green adaxially, round-raised and thicker than broad abaxially; basal veins 3 per side, with 1 to 2 free to base, posterior rib highly branched, naked 2–3 cm; *primary lateral veins* 5 to 7 per side, 2.5–3.5 cm apart, departing midrib at 50°–60° angles, curving gradually out to margin, darker than blade and deeply quilted-sunken, dark green along the margin of the vein and otherwise medium to pale green adaxially, narrowly raised, matte and darker or paler than blade surface abaxially, those in the lower 1/2 of the blade branched 1 to 2×; interprimary veins nearly equal to primary lateral veins; tertiary veins obvious, especially abaxially, arising from basal veins and primary lateral veins; numerous cross veins obvious on both sides, darker than surface; *basal veins* 8 to 12 pairs, the 1st pair often free to the base, the remainder variously coalesced and branching off the ± straight posterior rib, the 4 to 5 acroscopic pairs branched 1 to 2× before merging with the margin; cross veins usually prominulous even on fresh material; *sinus* narrowly obovate, naked along the posterior rib 3–5 cm. INFLORESCENCE 1 to 2 per axil; peduncle medium green, weakly glossy, 6–7 cm, 3.5–4 mm diam. on drying; *spathe* 12.5–13 × 2.1–2.3 cm on tube, moderately dark green and matte outside, paler and weakly glossy within; blade white on both surfaces; *spadix* 11.5–12 cm; staminate portion 6–6.5 cm, 1.3–1.4 cm diam., drying ca. 7 mm diam. midway; sterile portion ca. 2.5 cm, ca. 1.5 cm diam. at base, ca. 1.5 cm diam. at apex; pistillate portion 4–5 cm, 1.4–1.6 cm diam.; *pistils* pale yellow-green, 5- to 6-locular, 1.8–2 mm, 1.4–1.8 mm diam; placentation basal; ovules 8 to 10 per locule, ca. 0.15 mm, contained within an oblong opaque envelope, the envelope ca. 1 mm, attached at base of locule; funicle shorter than ovule; style irregularly 5- to 6-sided with rounded edges, minutely papillate, matte, drying bowl-shaped with 5 to 6 deep depressions, 0.5–0.7 mm wide; stigma consisting of 1 brush-like cluster for each locule, the entire width of the collective stigma 0.8–1 mm diam., drying flattened to saucer-shaped, irregularly angular, 1–1.5 mm diam. *Berries* not seen.

Distribution and habitat. *Philodendron furcatum* is known from the western slopes of the Colombian Cordillera Occidental, in the Bajo Calima region, and in Ecuador in the region of Lita–Alto Tambo, occurring in areas of Tropical rain forest transition to Premontane (T-rf/P), below 150 m. It has been found in regrowth forest on stream banks in dense shade.

IUCN Red List category. Conservation for *Philodendron furcatum* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001), since it is known from only the type specimen.

Discussion. This species is a member of subgenus *Philodendron*, section *Philodendron*, subsection *Achyropodium* (Schott) Engl. in Mart. It is characterized by its terrestrial habit; scandent stems; cataphylls that are unribbed, pale green, and that weather to pale fibers; and ovate to triangular-ovate, bullate, markedly bicolorous blades that are deeply cordate with lobes directed downward and outward forming a hippocrepiform sinus. The venation is particularly striking because the major veins are pale green but are sunken in dark green valleys adaxially, and the primary lateral veins are prominently forked (hence the epithet "furcatum"). Other unusual characteristics for the species are the peculiar branched styles emerging from each locule and the fact that the ovules

are enclosed within a cylindroid envelope in each locule.

Philodendron furcatum was known only in sterile condition when the junior author finished her Ph.D. thesis, and it was listed as species #5 in her thesis. The type specimen was later found in flower.

The species is closest to another new species from western Ecuador in the provinces of Carchi (*Madison & Besse 7024* from El Pailon, 45 km below Maldonado at 800 m) and Esmeraldas (*Croat 83373* from the Lita–San Lorenzo rd., 13.2 km SE of El Durango at 735 m, as well as *Croat 77233* and *Croat et al. 82216* from the Río Chuchubí, 6.4 km W of Río Lita at 609 m). That species differs in having petioles conspicuously scaly near the apex and having the primary lateral veins scarcely or not at all branched between the midrib and the margin. In contrast, *Philodendron furcatum* has glabrous petioles and the primary lateral veins are markedly branched between the midrib and the margin. In addition, the primary lateral veins of *P. furcatum* are markedly discolored dark green along their borders, which is not the case with the other new species from Ecuador.

A sterile collection from Chocó Department of Colombia (*Croat 70899* on the Pueblo Rico–Istmina rd., at Quebrada Antón, 15 km W of Santa Cecilia, 240 m) is very close to *Philodendron furcatum* in the coloration of the blade and in having some branched primary lateral veins, but it differs in having scaly petioles. The scales on that collection are not like those of the new species from Carchi and Esmeraldas because they are longer than broad, not broader than long. It may represent another new species.

Paratype. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 51.3, 9 Feb. 1990, *Croat & Watt 70407* (AAU, CUVC, K, M, MO, QCA, RSA, UB, VEN).

8. Philodendron heterocraspedon Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 40, 100 m, 5 Feb. 1990, *T. B. Croat & J. Watt 70170* (holotype, MO-3780906; isotypes, B, COL, CUVC, F, K, NY, PMA, QCNE, TULV, US).

Planta hemiepiphytica, interdum terrestris; internodia 1–13 cm longa, 1.5–5 cm diam.; cataphylla 6–29 cm longa, acute 1- vel 2-costata, basi intacta persistentia. Folia reflexo-patentia vel pendentia; petiolus late sulcatus basi, anguste complanatus apice, margine uno argute acuto, altero obtuse rotundato; lamina oblongo-elliptica, truncata vel interdum subcordata basi, 38–79 cm longa, 6–16 cm lata, supra subnitida vel velutina, nervis basalibus utroque 1 ad 3, omnibus liberis usque ad basim. Inflorescentiae in quaque axilla 1 ad 5; pedunculus 2.5–7 cm longus; spatha 16–22 cm longa, extus pallide viridis, lamina intus viridi-alba, tubo intus rubroviolaceo. Pistilla ca. 1.6 × 1.6–1.8 mm; ovarium 7- ad 9-loculare, loculis 5- ad 8-ovulatis.

Usually hemiepiphytic, occasionally terrestrial; stem appressed-climbing or scandent; *internodes* short, semiglossy, 1–13 × 1.5–5 cm, longer than broad, dark green, drying dark reddish brown or dark tan, epidermis coarsely white-ridged becoming brown scurfy ridged and finely transversely fissured, drying longitudinally wrinkled; roots few per node, drying medium brown; *cataphylls* D-shaped, 6–29 cm, sharply 1- to 2-ribbed, medium green, sometimes red, drying dark reddish brown, persisting intact at base. LEAVES reflexed-spreading to pendent, mostly clustered at apex of stem; *petioles* 12–49 cm × 1.5–5 mm (dry), C-shaped in cross section, broadly sulcate at base with one margin sharply acute and the other bluntly rounded, becoming narrowly flattened at apex, dark green, finely striate, drying dark brown; geniculum terete, swollen, 1–2 cm, drying dark and slightly scurfy; *blades* oblong-elliptic, subcoriaceous, moderately bicolorous, long-acuminate at apex, truncate to obtuse or sometimes slightly cordulate at base, 38–79 × 6–16 cm, 4.5–6.5(–8.9)× longer than wide, 1.4–2.4(–3.1)× longer than petiole, adaxial surface semiglossy to velvety, dark green, drying dull dark reddish brown, abaxial surface semiglossy, paler, drying glossy and paler; midrib convex and paler adaxially, bluntly acute and darker abaxially, drying concolorous or lighter adaxially, darker and raised abaxially; *primary lateral veins* 19 to 47 per side, 18–20 mm apart, spreading from midrib at 45° angles near the base becoming more acute distally (to 20°–25°), downturned at midrib then curving gradually out to margin, narrowly sunken adaxially, convex and darker than blade abaxially, drying concolorous or paler than blade adaxially, darker than blade and raised abaxially; *basal veins* 1 to 3 pairs per side, all free to base; interprimary veins often nearly as prominent as primary lateral veins; minor veins obscurely visible. INFLORESCENCE erect, 1 to 5 per axil; *peduncle* 2.5–7 cm × 4–6 mm, much shorter than petiole, white to medium green, finely striate, drying dark brown; *spathe* 16–22 cm, matte to weakly glossy, pale green to greenish white outside, long-tapered, not constricted; spathe blade 7–10 cm, greenish white inside; spathe tube 8–10 cm, glossy, cherry-red to red-violet to magenta inside; *spadix* cylindrical, 11–15 cm; pistillate portion pale green, cylindrical, 3.3–4 cm long on one side, 5.5–8 cm long on the other side, 7–9 mm diam.; staminate portion cylindrical, pale green, 7–10.2 cm × 7–8 mm; sterile staminate portion not apparent; *pistils* ca. 1.6 × 1.6–1.8 mm; ovary 7- to 9-locular, ovules with subbasal placentation, 5 to 8 per locule. INFRUCTESCENCE unknown.

Distribution and habitat. Philodendron heterocraspedon is endemic to Colombia and is known only

from the western slopes of the Colombian Cordillera Occidental, Valle Department, within the Bajo Calima region, and along the old Buenaventura–Cali rd. near the Río Aguaclara, in areas of Tropical rain forest transition to Premontane (T-rf/P), from 50 to 270 m. It has been collected from areas of regrowth forest, primary forest, and steep forested road banks.

IUCN Red List category. Conservation for *Philodendron heterocraspedon* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the area of the type locality, it is not yet known from other sites in Colombia.

Phenology. Philodendron heterocraspedon has been collected in flower in February and July, and in fruit in February and March. Sterile adult collections have been made in February, March, and July.

Discussion. The species is a member of subgenus *Philodendron*, section *Philodendron*, subsection *Philodendron*, series *Fibrosa* Croat and is characterized by its habit of growth, usually with most of the leaves clustered near the top of the stem, and long pendent leaf blades that have many arching primary lateral veins, markedly sunken adaxially. In addition, the petioles are deeply sulcate with one margin very acute and the other bluntly rounded (hence the epithet from the Greek compound "hetero" for differing and "craspedon" meaning edge or border). The distinctive long-tapered inflorescences are erect and nearly sessile, pale green or white.

This species is most easily confused with *Philodendron rhodospathiphyllum* Croat & D. C. Bay, especially in the dried state. However, *P. rhodospathiphyllum* differs in having shorter, wider leaf blades held in a spreading or slightly reflexed position and not pendent. It also has primary lateral veins that are farther apart and curve more gradually, and smaller inflorescences that are green outside and inside.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 9, *Croat 70120* (MO), *70121* (MO), *70130* (MO), *70131* (CUVC, MO), *70132* (MO); Km 11, *Croat 69295* (CUVC, MO); Km 14, *Croat 57543* (MO); Km 17.5, *Croat & Bay 75628* (CUVC, MO); Dindo area, *Gentry & Monsalve 48442A* (CUVC, MO); 1 km W of Carretera Gasolina and 6 km S of Buenaventura–Málaga rd., *Croat 69431* (CUVC, MO); Km 65–66, *Croat 71054* (MO); old Buenaventura–Cali rd., 2 km above Río Aguaclara, *Croat 57567* (MO); 14 km SE of Río Sabaletas, *Croat & Watt 70459* (MO); vic. of Bahia Málaga, near Base Naval Málaga, along trail along the edge of the bay W of base headquarters, *Croat & Gaskin 80583* (CUVC, HUA, MO).

Cultivated plants. COLOMBIA. **Valle:** Calima rd., cultivated at Wilson Botanical Garden, Costa Rica, accession #74–579, vouchered as *Croat 57254* (MO); cultivated by Marta Posada de Robledo, vouchered 1 July 1986 as *Croat 62766* (MO).

9. Philodendron hiberisiccans Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: vic. of Bahia Málaga, near Base Naval Málaga, along trail along the edge of the bay W of base headquarters, 20 m, 30 July 1997, *T. B. Croat & J. F. Gaskin 80584* (COL, CUVC, HUA, K, MO, PMA, US).

Planta hemiepiphytica; internodia 5–10 cm longa, usque ad 1.7 cm diam., obtecta fibris cataphyllorum; cataphylla usque ad 4 cm longa, ecostata, in fibras fatiscentia. Folia erecta; petiolus 10–15.5 cm longus, teres, complanatus adaxialiter marginibus acutis; lamina oblongo-elliptica, basi rotundata vel truncata, 20.5–47.5 cm longa, 4–9.5 cm lata, nervis lateralibus primariis utroque 5, basalibus utroque 3, omnibus liberis usque ad basim. Inflorescentiae in quaque axilla 1 ad 3; pedunculus 3.5–6 cm longus; spatha 6.8–8 cm longa, extus viridi-alba, intus alba. Ovarium 5- ad 6-loculare, loculis 20- ad 30-ovulatis.

Hemiepiphytic; stem appressed-climbing; *internodes* 5–10 mm, to 1.7 cm wide, wider than long, drying dark brown, epidermis obscured by cataphyll fibers; roots several per node, drying medium brown; *cataphylls* to 4 cm, unribbed, tapered at apex, medium green, drying dark brown to black, semi-intact at first node, weathering to thin pale brown fibers. LEAVES erect; *petioles* 10–15.5 cm × 3–4 mm (dry), terete, slightly flattened adaxially with moderately acute margins, medium green, weakly glossy, finely striate, drying dark brown to black, *blades* oblong-elliptic, subcoriaceous, slightly bicolorous, short-acuminate at apex, rounded to truncate at base, 20.5–47.5 × 4–9.5 cm, 2.8–5.4× longer than wide, 1.6–3× longer than petioles; adaxial surface semiglossy, drying dark reddish black; abaxial surface darker; *midrib* sunken and paler than blade adaxially, convex and darker abaxially; posterior veins 3 per side, free to midrib; *primary lateral veins* 5 per side, 3–4 cm apart, departing midrib at 20°–40° angles, gradually curving upward and outward to margins, weakly sunken adaxially, convex and darker abaxially, drying darker than blade; minor veins arising mostly from midrib, drying with a stitched appearance. INFLORESCENCES erect, 1 to 3 per axil; *peduncle* 3.5–6 cm × 3–4 mm, shorter than petiole, pale green, drying dark brown to black; *spathe* 6.8–8 cm; spathe blade greenish white outside, white inside; spathe tube yellow-green outside, white inside, drying dark reddish black; *spadix* cylindrical, barely tapered at apex, white throughout (pre-anthesis), ca. 5.8 cm; pistillate portion 1.8–2 cm long on one side, 2.4–3 cm long on the other side, 4–7 mm diam., drying medium brown; staminate portion ca. 3.5 cm × 5 mm (dry), drying dark brown; fertile staminate portion ca. 4.8 cm × 8 mm; sterile staminate portion 5–8 mm, drying dark reddish brown; *pistils* length and width unknown; ovary 5- to 6-locular, ovules

with basal placentation, 20 to 30 per locule. INFRUCTESCENCE unknown.

Distribution and habitat. *Philodendron hiberisiccans* is endemic to Colombia and is known only from the western slopes of the Colombian Cordillera Occidental, Valle Department, within the Bajo Calima region. It occurs in Tropical rain forest transition to Premontane (T-rf/P), below 150 m, and has been collected from two areas of regrowth forest.

IUCN Red List category. Conservation for *Philodendron hiberisiccans* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the area of the type locality, it is not yet known from other sites in Colombia.

Phenology. *Philodendron hiberisiccans* has been collected in flower in February and March.

Discussion. *Philodendron hiberisiccans* is a member of subgenus *Philodendron*, section *Macrobelium*, but further classification is unknown. Having basal placentation and a large number of ovules is not previously known to the senior author. The species is characterized by its short unribbed cataphylls that weather to pale fibers, and oblong-elliptic leaf blades, truncate or rounded at the base, drying reddish black (hence the epithet, "hiberus" meaning reddish black and "siccans" meaning dry) with the minor veins having a stitched appearance. Also characteristic are the small yellow-green inflorescences.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 11, *Monsalve 893* (MO); vic. of Bahia Málaga, near Base Naval Málaga, along trail along the edge of the bay W of base headquarters, *Croat & Gaskin 80584* (COL, CUVC, HUA, K, MO, PMA, US).

10. Philodendron monsalveae Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 52.4, 14 July 1993, *T. B. Croat & D. C. Bay 75734* (holotype, MO-04577522; isotypes, B, COL, CUVC, K, US).

Planta hemiepiphytica; internodia 2–17 cm longa, 5–30 mm diam.; cataphylla usque ad 35 cm longa, interdum 2-costata basi, plerumque acute 1-costata, decidua intacta. Folia patentia; petiolus 21–33 cm longus, 5–8 mm diam. in sicco, teres, obtuse sulcatus basi, subteres apice; lamina oblongo-elliptica, truncata basi, 35–57 cm longa, 13.5 25 cm lata, hebetata infra. Inflorescentiae in quaque axilla 3 ad 9; pedunculus 2–10 cm longus; spatha 4.3–7.5 cm longa, extus cerasina, lamina intus cremea, tubo intus rubro vel marronino. Pistilla 0.8–1 mm diam.; ovarium 5- vel 6-loculare, loculis 1-ovulatis.

Hemiepiphytic; stem appressed-climbing; sap creamy yellow to light tan; *internodes* smooth, 2–17 × 0.5–3 cm, longer than broad, usually dark green becoming gray-green, occasionally medium green to light reddish brown or tan, epidermis sometimes slightly scurfy and somewhat transversely fissured, drying yellowish tan and flaking; roots several per node, to 33 cm × 3–4 mm (dry), drying dark reddish brown; *cataphylls* to 35 cm, sometimes 2-ribbed at base but more usually sharply 1-ribbed, obtuse and apiculate at apex, pale green at base, rosy toward apex with pale margins, drying pale tan with light brown mottling, deciduous. LEAVES spreading; *petioles* 21–33 cm × 5–8 mm (dry), obtusely sulcate at base, becoming terete midway, subterete at apex, dark to olive-green, firm, semiglossy, drying olive-green with longitudinally wrinkled, flaking epidermis; geniculum slightly swollen, to 3 cm, darker than petiole, drying medium to dark brown; *blades* oblong-elliptic, moderately coriaceous, acuminate at apex, attenuate to truncate at base, 35–57 × 13.5–25 cm, 2.1–2.9(–4)× longer than broad, 1.6–1.9× longer than petiole; adaxial surface semi-glossy, dark green, often bicolorous, drying dull pale olive-green; abaxial surface matte, paler than adaxially, drying pale olive-green or tan; *midrib* flat, pale white, sometimes striate adaxially, narrowly to broadly round-raised and darker abaxially; *primary lateral veins* 5 to 14 per side, 2.5–4 cm apart, spreading from midrib at 55°–65° angles, acutely downturned at midrib, proceeding straight out toward margin, becoming very weak within 1 cm of margin, sunken adaxially, convex and darker than blade abaxially, drying paler than blade adaxially, paler than blade and raised abaxially; minor veins obscure. INFLORESCENCES pendent, enclosed in persistent rosy red prophyll, 3 to 9 per axil alternating with prophylls; *peduncle* curved, 2–10 cm × 2–4 mm (dry), much shorter than petiole, pale olive to medium green, glossy, somewhat striate, drying dark reddish brown; *spathe* cherry-red, bluntly rounded, white-apiculate at apex, barely constricted above tube, 4.3–7.5 cm; spathe blade 3–4.5 cm, cream-colored inside; spathe tube 2–3 cm, cherry-maroon outside, green becoming cherry-red to dark maroon inside, drying medium tan outside, with obvious resin lines above tube inside; *spadix* exserted at anthesis, tapered at apex, 4–7.7 cm; pistillate portion green to yellow-green with golden stigmas, cylindrical, 1.9–3 cm × 4.5–8 mm; staminate portion creamy white becoming yellowish brown, ellipsoid to clavate, 3–4.7 cm × 8–10 mm at widest point; sterile staminate portion ca. 0.7 × 10–11 mm, slightly paler than fertile staminate portion; *pistils* 0.8–1 mm diam.; ovary 5- to 6-locular, ovules with basal placentation, 1 per locule; sterile staminate flowers 2 mm, irregular. INFRUCTESCENCE unknown. JUVENILE PLANTS with narrow-elliptic, often falcate leaf blades, white cataphylls, and obscure primary lateral veins.

Distribution and habitat. *Philodendron monsalveae* is endemic to Colombia, known only from the western slopes of the Colombian Cordillera Occidental, in the Bajo Calima region. It occurs in Tropical rain forest transition to Premontane (T-rf/P), below 150 m, usually growing in dense forest.

IUCN Red List category. Conservation for *Philodendron monsalveae* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the Bajo Calima region, it is not yet known from other sites in Colombia.

Phenology. *Philodendron monsalveae* has been collected in flower in July and in fruit in February, and from July to October. Sterile collections have been made in February, March, and July.

Etymology. *Philodendron monsalveae* is named in honor of Miryam Monsalve, a Colombian botanist and illustrator, who has undertaken the tremendous task of producing and illustrating a complete flora of the Bajo Calima area in collaboration with the Missouri Botanical Garden and Smurfit Cartón de Colombia. She collected many of the earliest specimens of this species in the 1980s.

Discussion. The species is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Glossophyllum*, series *Glossophyllum* and is characterized by its smooth olive to gray stems, narrow-elliptic blades with few primary lateral veins widely spaced and becoming very weak within 1 cm of the margin, and clusters of small, cherry-red inflorescences wrapped in a persistent rosy red prophyll.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Río Calima, in forestry concession of Cartón de Colombia, 6.5 km beyond the Porton Tomar at Km 27, 22.3 km beyond Camp Portada Pulpapel, 33.3 km beyond main Calí–Buenaventura hwy., *Croat 61303* (HUA, MO); Buenaventura–Málaga rd., Km 11, *Croat 62774* (CUVC, MO), *70104* (CUVC, MO), *70112* (MO), *69303* (CUVC, MO), *Croat & Monsalve 61407* (MO, NY), *Bay 219* (CUVC, MO), *276* (CUVC, MO), *Monsalve 187* (MO), *364* (CUVC, MO), *1067* (CUVC, MO), *2005* (CUVC, MO); Km 12.5, *Croat 70148* (MO); Km 14, *Croat 57529* (MO); Km 17.5, *Croat & Bay 75627* (CUVC, MO); Km 33.3, *Croat 61275* (CUVC, F, G, GH, MO, QCNE, USM, VEN), *61303* (HUA, MO); Km 37, *Croat & J. F. Gaskin 79788* (MO); 1 km W of Carretera Gasolina, *Croat 69406* (CUVC, MO); Km 65–66, *Croat 71053* (JAUM, MO, UB); rd. to Juanchaco Palmeras, *Gentry et al. 48018* (CUVC, MO); Zaragosa, *Ramos 4140* (CUVC); vic. of Bahia Málaga, near Base Naval Málaga, along trail along the edge of the bay W of base headquarters, *Croat & J. F. Gaskin 80598* (CUVC, MO).

11. Philodendron ninoanum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 9, 150 m, 3 Feb. 1990, *T. B. Croat 70128* (holotype, MO-3789763; isotypes, B, CUVC, K, US).

Planta hemiepiphytica aut raro terrestris; internodia 1.5–19 cm longa, 2–6 cm diam., interdum costata; cataphylla 15–35 cm longa, ecostata aut acute 2-costata, decidua intacta. Folia erecta vel patentia; petiolus 15–76 cm longus, 8–18 mm diam., obtuse complanatus adaxialiter, juventute late alatus; lamina elliptica vel ovata, profunde cordata basi, 25.5–83.5 cm longa, 11–54 cm lata, nervis lateralibus primariis utroque 4 ad 6, basalibus utroque 5 vel 6. Inflorescentiae in quaque axilla 1 ad 5; pedunculus 8–14 cm longus; spatha apiculata, 9–11 cm longa, lamina extus rubra, intus alba, tubo extus virenti, intus rubro. Pistilla 2.5–3 × ca. 1.4 mm; ovulum (4)5- vel 6-loculare, loculis 1- ad 2-ovulatis.

Hemiepiphytic or rarely terrestrial; stem appressed-climbing or scandent, sap copious, brownish red to purple; *internodes* semiglossy, sometimes ribbed, 1.5–19 × 2–6 cm, longer than broad, dark green to gray-green to gray, becoming light brown to brown to gray, often scurfy, drying pale yellowish tan with flaky epidermis; roots few per node, drying medium tan or reddish brown, epidermis flaky; *cataphylls* 15–35 cm, unribbed or sharply 2-ribbed, medium green, pale green-lineate, drying pale white with wavy lineations, deciduous. LEAVES erect to spreading; *petioles* semiglossy, 15–76 × 0.8–1.8 cm (dry), obtusely flattened adaxially, medium green, pale green-lineate, drying olive-green; *blades* elliptic to ovate, moderately coriaceous, acuminate to long-acuminate at apex, deeply cordate at base, 25.5–83.5 × 11–54 cm, 1.5–2.7(–3.4)× longer than wide, (1.1–)1.5–1.8× longer than petiole, broadest at point of petiole attachment, margins rounded, adaxial surface semiglossy, dark green to yellowish green, drying dull grayish olive-green, abaxial surface semiglossy, paler than adaxially, drying semiglossy and paler than adaxially, sometimes slightly red, anterior lobe 23–61 × 11–54 cm, 2.2–3.9(–6.9)× longer than posterior lobe; posterior lobes 2–23 × 2.5–27 cm, rounded to obtuse at apex; sinus arcuate to parabolic or spatulate, 2–24 cm deep; *midrib* broadly sulcate and paler than blade adaxially, bluntly acute to narrow-rounded or convex abaxially, drying nearly concolorous on both sides; basal veins 5 to 6 per side, with 1 free to base, 4 to 5 coalesced for 1–6 cm, posterior rib not naked or naked up to 3 cm; *primary lateral veins*, 4 to 6 per side, 3–3.5 cm apart, spreading from midrib at 60°–65° angles, sharply downturned at midrib, proceeding straight out to margin, bluntly concave to sunken adaxially, convex and paler abaxially, drying concolorous to darker; minor veins moderately obscure, drying moderately visible and raised. INFLORESCENCE erect, 1 to 5 per axil; *peduncle* glossy, 8–14 cm, 4–8 mm diam. (dry), shorter than petiole, medium to pale green, thinly striate, drying olive-

green; *spathe* bluntly rounded with an apiculum 3–5 mm long at apex, 9–11 cm long, semiglossy, slightly constricted above tube; spathe blade 5.5–8 cm, pale green becoming white, then rosy red outside (at anthesis), white inside; spathe tube 3–6 cm, medium green outside, deep cherry-red to white inside; *spadix* barely exserted, extending slightly beyond spathe at anthesis, sessile, 9–11 cm; pistillate portion yellow-green to cream, cylindrical, 3–4 cm, to 1 cm diam. (dry); staminate portion white, clavate, 5.5–6.5 cm, to 1.5 cm diam. at widest point, 6–8 mm diam. at base (dry), broader than pistillate and sterile staminate portions; sterile staminate portion not obvious; *pistils* 2.5–3 × ca. 1.4 mm; ovary (4 to)5- to 6-locular, locules 1.8–2 × ca. 1.4 mm, ovules with basal placentation, 1 to 2 per locule. INFRUCTESCENCE with olive-green *berries*. JUVENILE PLANTS with petioles that are deeply sulcate, appearing winged, and blades that are elliptic and rounded to cordulate at base.

Distribution and habitat. *Philodendron ninoanum* is endemic to Colombia and is known from the western slopes of the Cordillera Occidental in Valle Department. It occurs in Tropical rain forest transition to Premontane (T-rf/P), ranging in elevation from 40 to 150 m. It has been collected in disturbed or degraded forest, dense primary forest, and along stream banks.

IUCN Red List category. Conservation for *Philodendron ninoanum* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the Bajo Calima region, it is not yet known from other sites in Colombia.

Phenology. *Philodendron ninoanum* has been collected flowering in February, July, and August, and in fruit in July, August, and November. Sterile collections with petioles both winged and wingless have been made in March, April, July, and December.

Etymology. *Philodendron ninoanum* is named in honor of Julio Niño, an official of the lumber company, Cartón de Colombia, who was extremely helpful in facilitating fieldwork at Bajo Calima. He was killed by guerrillas in August 1993 at Buenaventura.

Discussion. The species belongs to subgenus *Philodendron*, section *Macrobelium*, subsection *Glossophyllum*, series *Ovata* characterized by its deciduous cataphylls, deeply sulcate petioles appearing winged when young or juvenile, and elliptic to ovate and deeply cordate adult leaf blades with few widely spaced primary lateral veins. Also characteristic are the inflorescences that are green when young, then become rosy red on the spathe blade when mature, and are distinctly apiculate.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Río Calima, within forestry concession of Cartón de Colombia, 6.3 km N of Frente La Brea, Km 18 on main rd., ca. 6 km SE of village of San Isidro on Río Calima, *Croat 61324A* (MO); Km 11, *Croat 56354A* (MO), *62780* (CUVC, MO), *69326A* (CUVC, MO), *Monsalve 911* (CUVC, MO), *1092* (CUVC, MO); Km 17.5, *Croat & Bay 75632* (CUVC, MO), *75641A* (MO); Km 18, *Croat 61340* (CUVC, MO); 6 km S of Buenaventura–Málaga rd. on Carretera Gasolina, *Croat 69408* (CUVC, MO); 6 km N of Km 22, on Carretera Hanz, *Croat 69540* (CUVC, MO), *71086* (GH, MO, QCNE, USM); 4.5 km W of Km 28, *Bay 241* (CUVC, MO); Km 50.7, *Croat & Bay 75689* (CUVC, MO); Km 65–66, *Croat 71052* (MO); transect 5, *Gentry 35566* (MO); Zaragosa, *Ramos 3983* (CUVC).

12. Philodendron oblanceolatum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: ca. 18 km E of Buenaventura, 50 m, 14 Feb. 1939, *E. P. Killip & F. García 33250* (holotype, US-1770207; isotypes, B, G, K).

Planta hemiepiphytica, raro terrestris; internodia 1–5.5 cm longa, 4–35 mm diam., obtecta fibris cataphyllorum; cataphylla usque ad 12 cm longa, acute 1- vel 2-costata apice, persistentia basi. Folia patentia; petiolus 1.5–11 cm longus, 5–10 mm diam. in sicco, teres; lamina oblongo-obovata, anguste rotundata basi, hebetata infra, nervis lateralibus primariis utroque 20 ad 29. Inflorescentia solitaria; pedunculus 1–4 cm longus; spatha 12–18 cm longa, virens, lamina intus albida, tubo intus atromarronino. Pistilla ca. 1.3 × 0.8 mm; ovarium 4- vel 5-loculare, loculis 20- ad 30-ovulatis.

Hemiepiphytic, rarely terrestrial; appressed-climbing or scandent; *internodes* short, obscured by cataphyll fibers and roots, 1–5.5 cm × 0.4–3.5 cm, longer than broad, drying medium brown with flaky epidermis; roots several per node, drying light to medium brown; *cataphylls* to 12 cm, sharply 1- to 2-ribbed near apex, flattened on one side, pale green, drying medium tan or pale brown, bases persisting somewhat intact at upper nodes. LEAVES spreading; *petioles* firm, 1.5–11 cm × 5–10 mm (dry), terete, broadly rounded adaxially, narrowly rounded abaxiallly, medium green, matte, drying dull, medium olive-green; *blades* upright to spreading, clustering at the top of the stem, subcoriaceous, oblong-obovate, acuminate at apex, narrowly rounded at base, 24.5–78 × 5.5–21.5 cm, (3.1–)3.3–3.9(–4.4)× longer than wide, (4.2–)6.6–11.8(–25)× longer than petiole, broadest at or above middle, margins rounded in distal half, concave in proximal half, adaxial surface semiglossy, dark green, drying dull and dark olive-green, abaxial surface matte, paler than adaxially, drying glossy and reddish brown; *midrib* broadly convex at base to narrowly sunken at apex, marginally discolored, drying darker than blade adaxially, bluntly angular and drying darker than blade abaxially; *primary lateral veins* 20 to 29 per side, 5–23 mm

apart, spreading from midrib at 50°–60° angles, slightly downturned at midrib, proceeding straight out to within 1.5 cm of margin, then curving sharply toward apex, sunken adaxially, raised abaxially, drying concolorous or darker than blade adaxially, darker than blade abaxially; minor veins and minute cross veins clearly visible abaxially, departing from both midrib and primary lateral veins, drying obscure adaxially, darker than blade abaxially, with many, often interrupted, secretory canals clearly visible abaxially. INFLORESCENCE erect, solitary; *peduncle* 1–4 cm × 4–8 mm (dry), shorter than petiole, drying medium brown; *spathe* long-tapered, 12–18 cm, medium green, not constricted; spathe blade 6.5–11 cm, white inside; spathe tube 4–7 cm, dark maroon inside, drying dull medium brown; *spadix* sessile, 10–14 cm, white; pistillate portion 1.5–4 cm, slightly ellipsoid, to 1.1 cm diam. at widest point; staminate portion oblong, 5–9 cm, to 1.3 cm diam. near middle (dry), narrower than pistillate portion; sterile staminate portion not apparent; *pistils* ca. 1.3 × 0.8 mm; ovary 4- to 5-locular, ovules with axile placentation, 20 to 30 per locule. INFRUCTESCENCE unknown. JUVENILE PLANTS creeping, internodes 1–4 cm, 4 mm diam.

Distribution and habitat. *Philodendron oblanceolatum* is endemic to Colombia and is known only from the western slopes of the Cordillera Occidental, in the Bajo Calima region. It occurs in Tropical rain forest transition to Premontane (T-rf/P), below 150 m, and has been collected from primary forest and regrowth forest.

IUCN Red List category. Conservation for *Philodendron oblanceolatum* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the Bajo Calima region, it is not yet known from other sites in Colombia.

Phenology. *Philodendron oblanceolatum* has been collected in flower in February, and in fruit in February and March.

Discussion. The species is a member of subgenus *Philodendron*, section *Philodendron*, subsection *Canniphyllum* (Schott) Mayo and is characterized by its hemiepiphytic habit, short internodes obscured by cataphyll bases, and leaves that cluster at the top of the stem. It also has rather large leaf blades with a distinctive oblanceolate shape for which it is named. The leaf blades are also distinctive in showing obvious secretory canals below when dry and in being held erect or spreading on very short petioles, and the inflorescences are long, tapered, green and maroon within the spathe tube. One collection, *Cuatrecasas 16406*, noted that the spadix had an intense, unpleasant odor.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 9, *Croat 70110* (K, MO, US); Km 11, *Croat & Monsalve 61393* (COL, CUVC, MO), *Croat 69290* (CUVC, MO); Km 14, *Croat 57544* (MO); 6 km S of Buenaventura–Málaga rd. on Carretera Gasolina, *Croat 69419* (CUVC, MO); La Trojita, *Cuatrecasas 16406* (F, US).

13. Philodendron polliciforme Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 11, 3°56′N, 77°00′W, 130 m, 17 July 1988, *T. B. Croat 69342* (holotype, MO-3623098; isotypes, B, COL, CUVC, K, NY, US).

Planta hemiepiphytica, raro terrestris; internodia 1–6 cm longa, 8–45 mm diam., obtecta basibus cataphyllorum; cataphylla 4–12(–17) cm longa, ecostata, rubra vel rubro-violacea, persistentia basi. Folia patentia; petiolus 30.5–85.5 cm longus, 0.55–1.8 cm diam. in sicco, obtuse complanatus adaxialiter, interdum leniter costatus in medio; lamina triangulari-ovata, cordata basi, nervis lateralibus primariis sicutbasalibus utroque 5 ad 9. Inflorescentiae in quaque axilla 2 ad 6; pedunculus 3–10 cm longus; spatha 4.5–8.5 cm longa, polliciformis, lamina extus rubra vel marronina et viridi vel alba apice, intus albida, tubo extus rubro vel marronino, intus albido. Pistilla ca. 1.4 mm longa; ovarium 5-loculare, loculis 1-ovulatis.

Hemiepiphytic, rarely terrestrial; stem appressed-climbing or scandent; *internodes* short, semiglossy, usually obscured by cataphyll bases, 1–6 cm × 8–45 mm, longer than broad, medium brown, drying medium brown to tan, with transversely fissured flaking epidermis; *cataphylls* 4–12(–17) cm, unribbed, rounded at apex, red to red-violet, especially dark red at base becoming lighter and green at apex, persisting at base, becoming mushy, drying dark reddish brown. LEAVES spreading; *petioles* 30.5–85.5 cm × 0.5–1.8 cm (dry), obtusely flattened adaxially, sometimes with slight medial rib, medium green, pale-striate, moderately glossy, drying reddish brown; geniculum slightly swollen, 1–1.5 cm, tan, drying darker than petiole and somewhat shrivelled; *blades* triangular-ovate, moderately coriaceous, moderately bicolorous, long-acuminate at apex, cordate at base, margins rounded, 28.5–68.5 × 15–49 cm, 1.4–1.6(–1.9)× longer than wide, 0.8–1.1(–1.5)× as long as petiole, adaxial surface semiglossy, medium to dark green, drying dull olive-green, often tearing between primary lateral veins, abaxial surface paler than adaxially, drying dull and paler than adaxially; anterior lobe 24–54 × 15–49 cm, 1.8–2.8(–3.3)× longer than posterior lobes, broadest at point of petiole attachment; posterior lobes 7.5–23.5 × 7.5–23 cm, rounded; sinus spatulate to rhombic, 4.5–18 cm deep; *midrib* flat and paler than blade adaxially, drying olive to medium tan, narrowly rounded and paler than blade abaxially, drying light tan; *primary lateral veins* 5 to 9 per side, 2–4 cm apart, spreading from midrib at 65° angles, downturned at midrib, then curving gradually upward

to margin, obtusely sunken adaxially, convex and paler than blade abaxially, drying lighter than blade; *basal veins* 5 to 9 per side, with 2 free to base, 3 coalesced to 8 cm, 5 coalesced to 6 cm, 7 coalesced to 4 cm, well-developed posterior rib not naked or naked up to 3 cm, paler than blade adaxially and abaxially, drying light tan and raised abaxially; minor veins moderately obscure, arising from midrib. INFLORESCENCE erect or spreading, 2 to 6 per axil, enclosed in a persistent prophyll; *peduncle* 3–10 cm × 2–3 mm (dry), much shorter than petiole, white in the lower 1/3, red to apex, drying dark reddish tan; *spathe* thumb-shaped, often caudate-acuminate when immature, 4.5–8.5 cm, slightly constricted; spathe blade 2–3 cm, red to maroon becoming green to white at apex outside, white inside; spathe tube 2.5–5 cm, red to maroon outside, white inside, drying dark rusty tan; *spadix* cylindrical, 3.5–6 cm; pistillate portion pale green, 2–3 cm × ca. 2.6 mm; staminate portion creamy white, 2–3 cm × ca. 2.5 mm at base, ca. 3.2 mm diam. at apex; sterile staminate portion not apparent; pistils ca. 1.4 × 0.6 mm at base, ca. 0.3 mm diam. at apex; *ovary* 5-locular, ovules with basal placentation, 1 per locule. INFRUCTESCENCE with orange *berries*. JUVENILE PLANTS differ in having internodes that are much longer than broad, leaf blades long-triangular, shallowly cordate at base, and lacking posterior rib.

Distribution and habitat. *Philodendron polliciforme* is endemic to Colombia and is known only from the western slopes of the Cordillera Occidental, Valle Department, within the Bajo Calima region. It occurs in Tropical rain forest transition to Premontane (T-rf/P), below 150 m, and has been collected from primary forest, regrowth forest, and from stream banks in deep ravines.

IUCN Red List category. Conservation for *Philodendron polliciforme* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the Bajo Calima region, it is not yet known from other sites in Colombia.

Phenology. *Philodendron polliciforme* has been collected in flower in June, July, and December.

Discussion. The new species is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Glossophyllum*, series *Ovata* characterized by stems with short internodes obscured by persistent cataphyll bases, red cataphylls, large triangular-ovate leaf blades with a highly developed posterior rib, and long petioles. The small thumb-shaped, red to maroon inflorescences with white apices (hence the epithet from the Latin "pollex" meaning thumb and "forma" meaning shape) are most distinctive.

This species may sometimes be confused with *Philodendron canicaule* because they have similar growth habits and leaf blades with similar shapes and proportions. In addition, they both have small inflorescences on short peduncles. However, *P. canicaule* differs in having longer internodes that are distinctively gray-green, green deciduous cataphylls, leaf blades that are usually matte abaxially and dry slightly red, and inflorescences with green and white spathes (as opposed to red).

Paratypes. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 9, *Croat 70111* (MO); Km 11, *Croat & Monsalve 61400* (F, HUA, JAUM, MO), *Croat 61411A* (CUVC), *69317* (MO), *69342* (CUVC, MO), *Monsalve 184* (MO), *Juncosa 2120* (CUVC, MO), *Gentry 35276* (MO), *van Rooden et al. 438* (MO); Lijal–Gasolina rd. bifurcation, *Gentry et al. 62927* (CUVC, MO); Dindo area, *Gentry & Monsalve 48433* (CUVC, MO), *Gentry et al. 53302* (CUVC, MO); Carretera Hanz, *Croat 71085* (MO); Buenaventura–Málaga rd., Km 33, *Croat 61386* (MO); Km 44, *Croat & Watt 70215* (MO); Km 49, *Croat & Bay 75813* (CUVC, MO), *75825* (MO, USM); Km 50.5, *Croat & Watt 70341* (MO), *Croat & Bay 75700* (MO); Zaragosa, *Ramos 4031* (CUVC).

14. Philodendron rhodospathiphyllum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 11, 3°56′N, 77°00′W, 130 m, 5 Feb. 1990, *T. B. Croat & J. Watt 70201* (holotype, MO-3780810; isotypes, B, CUVC, K, US).

Planta hemiepiphytica; internodia 0.5–3 cm longa, 1–3.5 cm diam., dense obtecta fibris cataphyllorum; cataphylla usque ad 20 cm longa, ecostata, in fibras pallidas fatiscentia et persistentia. Folia patentia vel reflexo-patentia; petiolus 14–46 cm longus, 4–8 mm diam. in sicco, acute et anguste sulcatus adaxialiter, leniter costatus in medio; lamina oblongo-elliptica, rotundata vel truncata et plerumque inequalis basi, 33.5–63 cm longa, 10.5–16 cm lata, nervis lateralibus primariis utroque 14 ad 48, basalibus utroque 2. Inflorescentiae in quaque axilla 1 ad 4; pedunculus 1–4 cm longus; spatha 8–13 cm longa, virens, lamina intus virenti vel flavoviridi, tubo intus virenti. Pistilla 3.2–3.4 × 2.3–3 mm; ovarium 6- vel 7-loculare, loculis ca. 22-ovulatis.

Hemiepiphytic; stem appressed-climbing; *internodes* short, densely covered with cataphyll fibers, 0.5–3 × 1–3.5 cm, thicker than broad, pale green, drying medium tan with longitudinal wrinkles; roots several per node, reddish brown, drying medium brown; *cataphylls* to 20 cm, unribbed, rounded at apex, soft, medium green, drying as pale fibers with reddish brown epidermis, persisting intact at upper nodes, then weathering to pale fibers. LEAVES clustered near apex of stem, spreading to reflexed-spreading; *petioles* 14–46 cm × 4–8 mm (dry), thicker than broad, sharply and narrowly sulcate adaxially

with a faint medial rib, narrowly rounded abaxially, olive-green, firm, drying dark olive-green; geniculum swollen, 5–15 mm, darker in color, drying darker and sometimes wrinkled; *blades* oblong-elliptic, subcoriaceous, moderately bicolorous, long-acuminate at apex, rounded to truncate, often asymmetric at base, 33.5–63 × 10.5–16 cm, (2.7–)3–4.9× longer than wide, 1.3–2.6(–2.9)× longer than petiole, broadest close to middle, adaxial surface semiglossy, dark green, drying dull olive-green to olive-brown, abaxial surface semiglossy, paler than adaxial surface or yellowish green, drying glossy, light to medium reddish brown; *primary lateral veins* 14 to 48 per side, 1–3.5 cm apart, spreading from midrib at 45°–65° angles, downturned at midrib, curving upward out to margin, narrowly sunken adaxially, convex and darker than blade abaxially, drying lighter or concolorous adaxially, darker than blade abaxially; *basal veins* 2 per side, all free to base; interprimary veins often nearly as prominent as primary lateral veins, drying equal in color to primary lateral veins, sometimes with a stitched appearance abaxially; minor veins moderately obscure. INFLORESCENCE erect, 1 to 4 per axil; *peduncle* 1–4 cm × ca. 5 mm, much shorter than petiole, pale green to white, striate at apex, drying medium brown; *spathe* 8–13 cm, semiglossy, pale to dark green, white-streaked at base outside, long-tapered at apex when immature, constricted above tube; spathe blade 6–8 cm, medium green to yellow-green inside; spathe tube 2–5 cm, dark green outside, medium green inside; *spadix* cylindrical, 7–9 cm; pistillate portion pale yellow-green, 3.7 cm long on one side, 4.5 cm long on the other side, 1.6 cm diam. midway (dry); staminate portion white, slightly ellipsoid, 6–8 cm, to 11 mm diam. (dry); sterile staminate portion to 1 cm, 6–8 mm diam. (dry), slightly narrower than pistillate and fertile staminate portions; *pistils* 3.2–3.4 × 2.3–3 mm; *ovary* 6- to 7-locular, ovules with axile placentation, about 22 per locule. INFRUCTESCENCE with white (immature) *berries*.

Distribution and habitat. *Philodendron rhodospathiphyllum* is endemic to Colombia and is known from the western slopes of the Cordillera Occidental, in the Bajo Calima region, from 40 to 100 m, and from the valley of the Río Dagua up to 710 m. It occurs in Tropical rain forest transition to Premontane (T-rf/P) and has been collected in older regrowth and primary forest.

IUCN Red List category. Conservation for *Philodendron rhodospathiphyllum* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the Bajo Calima region, it is not yet known from other sites in Colombia.

Phenology. *Philodendron rhodospathiphyllum* has been collected in flower and fruit in February and July. Adult plants have been collected sterile in July.

Discussion. The species is a member of the subgenus *Philodendron*, section *Philodendron*, subsection *Canniphyllum* and is characterized by its hemiepiphytic habit with leaves clustered near the top and usually held in a reflexed-spreading position, very short internodes obscured by pale cataphyll fibers, and oblong-elliptic leaf blades, truncate or rounded at the base, appearing very similar to those of the genus *Rhodospatha*, hence its epithet. Also characteristic is the long-tapered inflorescence with a white-striate spathe, green inside and out.

Philodendron rhodospathiphyllum can be confused with *P. heterocraspedon* especially as a dried herbarium specimen. The latter species differs in having pendent longer and narrower blades usually drying much darker reddish brown. It also has more, closer primary lateral veins that curve upward at more acute angles. In addition, its inflorescences are longer (16–22 cm long as compared to 8–13 cm long in *P. rhodospathiphyllum*) and very pale green to white with the inside of the tube cherry-red.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 11, *Croat 69322* (CUVC, MO); Km 33.3, *Croat 61292* (COL, HUA, JAUM, MO, UB, VEN); Km 44, *Croat & Watt 70201* (MO); Km 65–66, *Croat 71050* (MO), *71056A* (CUVC); Yatacué, valley of Río Dagua, *Gentry & Monsalve 48269* (MO); Bahia Málaga, vic. of Base Naval Málaga, along rd. to Buenaventura, ca. 1 km from base ca. Km 104, *Croat & Gaskin 80484* (CUVC, MO).

15. Philodendron rubromaculatum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 11, 11 July 1993, *T. B. Croat & D. Bay 75621* (holotype, MO-04588379; isotype, CUVC).

Planta hemiepiphytica; internodia 3–6 cm longa, 5–10 mm diam., interdum leniter complanata in latere uno; cataphylla 6–8.5 cm longa, acute 2-costata, decidua intacta. Folia patentia; petiolus 3.5–6 cm longus, 2–4 mm diam. in sicco, late sulcatus; lamina elliptica, attenuata vel truncata basi, 10–14.4 cm longa, 3.5–6 cm lata, infra rubro-punctata, nervis omnibus indistinctis. Inflorescentia solitaria; pedunculus 6–9.2 cm longus; spatha 4.2–5.5 cm longa, lamina extus alba vel flavida, tubo extus flavoviridi. Pistilla 2–2.4 × 1.4–1.8 mm; ovarium 5-loculare, loculis 2-ovulatis.

Hemiepiphytic; stem appressed-climbing; *internodes* 3–6 cm × 5–10 mm, sometimes weakly flattened on one side, light yellow-green, epidermis semiglossy, drying smooth, reddish tan to red-brown;

roots few at each node, smooth, drying dark brown; *cataphylls* 6–8.5 × ca. 1.5 cm, sharply 2-ribbed, rounded at apex, light yellow-green, drying reddish tan or red-brown, deciduous. LEAVES spreading; *petioles* 3.5–6 cm × 2–4 mm (dry), broadly and bluntly sulcate, light green, drying yellowish tan to reddish tan with loose wrinkled epidermis; *blades* elliptic, subcoriaceous, acuminate at apex, attenuate to truncate at base, 10–14.4 × 3.5–6 cm, 2–3× longer than wide, 1.9–2.5(–3.2)× longer than petiole; adaxial surface dark green, semiglossy, drying dull olive-green; abaxial surface pale yellow-green, drying reddish tan or reddish brown with minute red punctations; *midrib* broadly rounded (almost flat), paler than blade, drying light tan adaxially, narrowly rounded and paler abaxially, drying much paler; all other veins obscure on both surfaces. INFLORESCENCES solitary; *peduncle* terete, 6–9.2 cm × ca. 2 mm (dry), slightly longer than petiole, semi-glossy, light green, drying olive-green; *spathe* curved, apiculate, not constricted, 4.2–5.5 cm, uniform in width, 8–11 mm wide (dry), drying light reddish tan; spathe blade white to yellow outside; spathe tube yellow-green outside, *spadix* cylindrical, 4.2–4.4 cm; pistillate portion yellow, 1.8–2 cm, fairly uniform in width, 3–4 mm wide (dry); staminate portion 2–3.5 cm; sterile staminate portion 4–6 mm, slightly narrower than pistillate portion and fertile staminate portion; *pistils* 2–2.4 × 1.4–1.8 mm, *ovary* 5-locular, ovules with basal placentation, 2 per locule. INFRUCTESCENCE unknown.

Distribution and habitat. *Philodendron rubromaculatum* is endemic to Colombia and is known only from the type locality on the western slopes of the Cordillera Occidental, in the Bajo Calima region, an area of Tropical rain forest transition to Premontane (T-rf/P), below 150 m, growing in dense regrowth forest.

IUCN Red List category. Conservation for *Philodendron rubromaculatum* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). There is no reason to assume that it is exceedingly rare because only a tiny fraction of the Bajo Calima region has been studied, but it has not been collected elsewhere from other sites in Colombia.

Phenology. *Philodendron rubromaculatum* has been collected in flower in January, February, and July.

Discussion. *Philodendron rubromaculatum* is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Glossophyllum*, series *Glossophyllum* characterized by its appressed-climbing hemiepiphytic habit, deciduous cataphylls, and small elliptic blades that are pale yellow-green abaxially and dry reddish tan with red punctations (hence the epithet from the Latin "ruber" meaning red and "maculatus" meaning spotted). Also distinctive are its small, yellow-green inflorescences with yellow female flowers.

Philodendron rubromaculatum is somewhat similar to *P. longipes* Engler as they both have elliptic blades with obscure veins and small, slender, cylindrical inflorescences. However, *P. longipes* has much larger blades that are never punctate and dry light olive-green on both sides, cataphylls that persist at the bases, and inflorescences that are green on the spathe tube and yellow-green on the spathe blade, with green female flowers.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 11, *Croat & Bay 75621* (CUVC, MO), *Kennedy & Andrews 1315A* (SEL), *Kennedy 754* (F).

16. Philodendron striatum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 35.2, 100 m, 15 July 1993, *T. B. Croat & D. C. Bay 75751* (holotype, MO-04588392; isotypes, B, COL, CUVC, F, K, NY, PMA, QCNE, US, VEN).

Planta terrestris, interdum hemiepiphytica; internodia 2–7 cm longa, 2–6 cm diam., grosse albo-striata; cataphylla usque ad 13 cm longa, ecostata, persistentia intacta. Folia erecta vel patentia; petiolus 23–125 cm longus, 5–10 mm diam. in sicco, teres, obtuse subcomplanatus adaxialiter, grosse albo-striatus; lamina ovata, profunde cordata basi, 27–60 cm longa, 18.5–44 cm lata, hebetata infra, nervis lateralibus primariis utroque 8 ad 11, basalibus utroque 5 ad 7. Inflorescentiae in quaque axilla 1 ad 5; pedunculus 13–16 cm longus, grosse albo-striatus; spatha 15–18 cm longa, lamina untrinque alba, tubo extus viridi vel flavoviridi, intus albo. Pistilla ca. 2.2 mm longa; ovarium 4- vel 5-loculare, loculis ca. 20-ovulatis.

Terrestrial or sometimes hemiepiphytic; *internodes* short, semiglossy, 2–7 × 2–6 cm, shorter than long, medium green with coarse white striations, drying dark tan or medium brown with longitudinally wrinkled slightly flaky epidermis; *cataphylls* to 13 cm, unribbed, gradually tapered at the apex, yellow-green, drying with dark brown pieces of epidermis over thin pale fibers, persisting intact but becoming mushy and dark brown. LEAVES erect to spreading; *petioles* 23–125 cm × 5–10 mm (dry), terete, obtusely flattened adaxially, spongy, medium green with coarse white striations, semiglossy, drying dark brown, often with a darker brownish black geniculum; *blades* ovate, moderately coriaceous, obtuse-acuminate at the apex, deeply cordate at base, 27–60 × 18.5–44 cm, 1.2–1.6× longer than wide, 0.5–0.8× as long as petiole; adaxial surface semiglossy, dark green, drying glossy and very dark olive-

green to black; abaxial surface matte to weakly glossy, paler than adaxially, drying weakly glossy; anterior lobe 22–45.5 × 18.5–44 cm, 2–2.6× longer than posterior lobes; posterior lobes 8.5–21.5 × 9–24.5 cm, rounded to rectangular; sinus spatulate to rhombic, 4–15 cm deep; *midrib* flat and paler than blade adaxially, narrow-rounded, matte, darker than blade abaxially; *primary lateral veins* 8 to 11 per side, spreading from midrib at 50°–60° angles, curving gradually toward apex, more abruptly so at margin, downturned at midrib, narrowly sunken and paler than blade adaxially, convex and darker than blade abaxially, drying dark brown; *basal veins* 5 to 7 per side, 2 to 3 veins free, 4 to 5 coalesced for 2–4 cm, not to barely naked, drying dark brown; interprimary veins obvious; secondary veins numerous, fine, drying with a stitched appearance; cross veins numerous, indistinct, minute. INFLORESCENCES erect; 1 to 5 per axil; *peduncle* 13–16 cm × 3–5 mm (dry), much shorter than petiole, medium green with coarse white striations, drying dark brown to black; *spathe* long-tapered, constricted above tube, semiglossy, 15–18 cm, drying dark brown; spathe blade white on both surfaces; spathe tube pale green to medium yellow-green with white margins outside, white-speckled inside; *spadix* weakly exserted from the spathe at anthesis, 9–13 cm; pistillate portion greenish white, cylindrical, 3.8–5 cm × 9–11.5 mm; staminate portion 6–8.5 cm; fertile staminate portion white, ellipsoid, 4–6 cm × 7.5–11 mm at widest point, barely tapering at apex, narrower than pistillate portion; sterile staminate portion 1–2.5 cm × 9–10.5 mm, narrower than pistillate and fertile staminate portion; *pistils* 2.2 mm; ovary 4- to 5-locular, ovules with axile placentation, about 20 per locule. INFRUCTESCENCE to 13 cm, pistillate portion 5–6.5 cm.

Distribution and habitat. *Philodendron striatum* is known only from the western slopes of the Colombian Cordillera Occidental, Valle Department, within the Bajo Calima region. It occurs in Tropical rain forest transition to Premontane (T-rf/P), below 150 m. All collections are from dense forest, usually on steep hillsides.

IUCN Red List category. Conservation for *Philodendron striatum* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although locally common in the Bajo Calima region, it is not yet known from other sites in Colombia.

Phenology. *Philodendron striatum* has been collected in flower in February and July, and in fruit in February.

Discussion. The species is a member of subgenus *Philodendron*, section *Philodendron*, subsection *Philodendron*, series *Philodendron* and is characterized by its terrestrial habit; the coarse white striations found on the internodes, petioles, peduncles, and inside the spathe (hence its epithet); unribbed cataphylls that weather to thin fibers; and greenish black–drying cordate blades with few primary lateral veins and a matte abaxial leaf blade surface. Also characteristic are the inflorescences with white spathe blades outside and inside, and spathe tubes yellow-green outside and white within.

A species that can be mistaken for *Philodendron striatum* is *P. venulosum* Croat & D. C. Bay. These two species can both occur as terrestrials and have similarly shaped blades. The latter species differs by more often growing as a hemiepiphyte, its 2-ribbed cataphylls that persist as thick coarse fibers with reddish brown bases, its leaf blades that are semiglossy below drying dark reddish green, and its bluntly rounded inflorescences with pale green blades and rose-colored tubes.

Paratypes. COLOMBIA. **Valle:** Buenaventura–Málaga rd., Km 35.2, *Croat & Bay 75751* (CUVC, MO); Km 50.7, *Croat & Bay 75698* (MO); Km 51.3, *Croat & Watt 70360* (G, GH, HUA, JAUM, MEXU, MO, QCNE, TEX, UB, USM); old Buenaventura–Cali rd., 12 km S of Sabaletas (Río Sabaletas), *Croat 70446* (CUVC, MO); Bahia Málaga, vic. of Base Naval Málaga, along rd. to Buenaventura, ca. 1 km from base ca. Km 104, *Croat & Gaskin 80452* (CAS, COL, IMB, MO, P, SEL).

17. Philodendron suberosum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 11, 4 July 1986, *T. B. Croat 62785* (holotype, MO-3435782; isotypes, B, COL, CUVC, F, K, NY, PMA, QCNE, US).

Planta hemiepiphytica, interdum epiphytica; internodia 3–25 cm longa, 1–3 cm diam.; epidermis suberosa; cataphylla usque ad 20 cm longa, ecostata, interdum 2-costata apice. Folia patentia; petiolus 15–42(–58) cm longus, 5–10 mm diam. in sicco, teres, obtuse sulcatus basi; lamina ovato-elliptica vel ovata, cordata basi, hebetata infra, 29–54 cm longa, 12–37 cm lata, nervis basalibus utroque 6 ad 8, omnibus liberis usque ad basim. Inflorescentiae in quaque axilla 3 ad 6(10); pedunculus 3–10.5 cm longus; spatha 5.5–11 cm longa, ad margineum apiculumque albo, lamina extus cerasina, intus cremeo-alba, tubo extus viridi, suffuso rubro apice. Pistilla ca. 1.5 × 1.6–2 mm; ovarium 6- vel 7-loculare, loculis 2- vel 3-ovulatis.

Usually hemiepiphytic, sometimes epiphytic; stem appressed or climbing; sap brown with fruity odor; *internodes* 3–25 × 1–3 cm, longer than broad, medium brown to reddish brown; epidermis scurfy to deeply reticulate-fissured appearing corky, drying medium brown and deeply reticulate-fissured; roots few per node, drying red-brown with flaky epidermis;

cataphylls to 20 cm, unribbed to sometimes 2-ribbed near apex, bluntly rounded at apex, medium green, tinged red or purple-spotted at base, drying reddish brown with paler margins, becoming soft with thin brown epidermis, then deciduous. LEAVES spreading; *petioles* 15–42(–58) cm × 5–10 mm (dry), terete, medium green, firm, obtusely to broadly sulcate at base, weakly striate at apex, drying dull dark olive-green with many longitudinal wrinkles; geniculum striate, to 5 cm, usually drying dark brown to black, often wider than petiole; *blades* ovate-elliptic to ovate, coriaceous, acuminate at apex, cordate at base, rounded along margins, 29–54 × 12–37 cm, 1.3–1.8(–2.4)× longer than wide, 0.9–1.2(–2.1)× as long as petiole; adaxial surface moderately glossy, dark green, drying glossy pale gray-green; abaxial surface matte, paler than adaxially, drying dull and barely paler than adaxial surface; anterior lobe 39.5–46 × 12–37 cm, 4.2–6.6(–8.1) cm longer than posterior lobes; posterior lobes 5–10.5 × 7–11.5 cm; sinus arcuate to parabolic, 1.3–6 cm deep; *midrib* flat, medium green adaxially, convex and sometimes purple-spotted abaxially; *primary lateral veins* 14 to 20 per side, spreading from midrib at 60°–75° angles, downturned at midrib, 5 mm apart near base widening to 4 cm apart near apex; *basal veins* 6 to 8 per side, all free to base; minor veins distinct; all veins drying concolorous and sunken adaxially, darker than blade or sometimes paler than blade and raised abaxially. INFLORESCENCE erect to spreading, 3 to 6(to 10) per axil, often enclosed in a persistent pink prophyll that dries reddish brown; *peduncle* 3–10.5 cm, 3–5 mm diam. (dry), much shorter than petiole, pale green, sometimes faintly striate, drying dark brown, moderately flattened; *spathe* 5.5–11 cm, rounded and slightly apiculate at apex, barely constricted above the tube, margins and apiculum white, drying dark to medium brown, sometimes reddish brown; spathe blade brick to cherry-red, sometimes with purple ring-like or pale spots, or green speckles outside, creamy white with orange resin canals in lower 2/3 inside; spathe tube pale green at base, upper part tinged red to cherry-red, sometimes pale spotted outside; *spadix* exserted from spathe at anthesis, clavate, 7.4–8.5 cm; pistillate portion yellow-green becoming pink, 1.5–3 cm, 8–10 mm diam. at base (dry), 6–8 mm diam. at point where it meets the staminate portion (dry); staminate portion creamy white, 4–5.5 cm, somewhat constricted above the pistillate portion; fertile staminate portion clavate, 4.5–5 cm × 5–7 mm at base, 8–12 mm wide 1 cm from apex; sterile staminate portion not obvious; *pistils* ca. 1.5 × 1.6–2 mm; *ovary* 6- to 7-locular, ovules with subbasal placentation, 2 to 3 per locule; sterile staminate flowers ca. 4 × 9–10 mm. INFRUCTESCENCE unknown. JUVENILE PLANTS differ in having ecordate, broadly elliptic leaf blades.

Distribution and habitat. *Philodendron suberosum* is endemic to Colombia and is known only from the western slopes of the Cordillera Occidental in the Chocó and Valle departments. It occurs in Tropical wet forest (T-wf) and Tropical rain forest transition to Premontane (T-rf/P), at elevations below 150 m, in dense primary or regrowth forests.

IUCN Red List category. Conservation for *Philodendron suberosum* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), since it is known from six collections and has been found in both Chocó and Valle departments and many separate localities.

Phenology. *Philodendron suberosum* was collected in flower in February, July, August, and November, and in fruit in August. Sterile adult collections were made in March, July, and December. The inflorescence was noted as being sweetly aromatic.

Discussion. The species is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Macrobelium*, series *Macrobelium* and is characterized by its reticulate-fissured stem internodes with a corky appearance for which it is named, from the Latin "suber" or cork (cork tree); elliptic to barely cordate blades with basal veins that do not coalesce; primary lateral veins becoming wider apart toward the apex; and large clusters of inflorescences, with peduncles that are much shorter than the petioles, and with spathes that are pale green on the tube and have cherry-red blades.

Philodendron suberosum is somewhat similar to *P. trojitense* Croat & D. C. Bay; however, that species differs in having stem epidermis that is only transversely fissured (not appearing corky), and blades that are longer and narrower (2–3.5× longer than wide) with fewer primary lateral veins consistently widely spaced (3–7.5 cm apart). In addition, the inflorescences are long-apiculate and pale yellow with red-violet spots, not solid dark red like *P. suberosum*.

The only other *Philodendron* with which this species might be confused is *P. discretivenium*, but the latter species does not have a corky stem epidermis, the blades have coalesced basal veins, and the inflorescences have spathes that are greenish white on the tubes, with paler blades.

Paratypes. COLOMBIA. **Chocó:** Quibdó–Istmina rd., S of Río Rancherita, Km 31 and 32, *Croat 57364*, *57371* (MO). **Valle:** Buenaventura -Málaga rd., Km 9, *Croat 70108* (MO); Km 11, *Croat 62785* (CUVC, MO), *69296* (COL, CUVC, MO), *Monsalve 163* (CUVC, MO), *3180* (CUVC, MO); Km 12.5, *Croat 70145* (MO); Km 14, 4 km from Río Calima,

Croat 57556 (MO); Km 22, Carretera Hans, *Croat 69420* (MO, CUVC), *69483* (CUVC, MO); Km 40, Canalete area, *Gentry et al. 59602* (CUVC, MO); 4 km W of Km 28, *Bay 253* (CUVC, MO); San Isidro–Juanchaco rd., near San Isidro, *van Rooden et al. 325* (MO); Dindo area, *Gentry et al. 65525* (CUVC, MO), *Gentry & Monsalve 48437* (CUVC, MO); transect 3, *Gentry 35438* (MO); transect 4, *Gentry 35513* (MO); transect 6, rd. to Juanchaco Palmeras, *Gentry et al. 47944* (CUVC, MO); Bahía de Buenaventura, Quebrada de San Joaquín, *Cuatrecasas 19934* (F); cultivated at Wilson Botanical Garden, Costa Rica, *Croat 57267* (MO).

18. Philodendron tricostatum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Málaga rd., Km 52.4, 4°03′N, 77°05′W, 140 m, 14 July 1993, *T. B. Croat & D. C. Bay 75727* (holotype, MO-4577535; isotypes, B, COL, CUVC, K, US).

Planta hemiepiphytica, raro terrestris; internodia 1–10 cm longa, 1–5 cm diam., interdum 1-costata, obtecta fibris cataphyllorum; cataphylla 8–20 cm longa, acute 2-costata, plerumque suffusa rubra, in fibras crassas fatiscentia et persistentia. Folia erecto-patentia; petiolus 13.5–70 cm longus, 3–8 mm diam. in sicco, subteres, anguste sulcatus, marginibus obtusis basi, subcomplanatus adaxialiter 3-costata apice; lamina triangulari-ovata, profunde cordata basi, 18–59 cm longa, 10–31 cm lata, nervis lateralibus primariis utroque 4 ad 6, basalibus utroque 5 ad 10. Inflorescentiae in quaque axilla 2; pedunculus 3–6.2 cm longus; spatha 16–17.5 cm longa, lamina extus alba, intus nitida, tubo extus roseovinaceo, intus rubroviolaceo. Pistilla ca. 2 mm longa; ovarium 6-loculare, loculis 10- ad 20-ovulatis.

Hemiepiphytic, rarely terrestrial; stem appressed-climbing or scandent; *internodes* semiglossy, sometimes 1-ribbed, 1–10 × 1–5 cm, longer than broad, medium green to brown, drying gray-brown, obscured by cataphyll fibers; roots few per node; *cataphylls* 8–20 cm, sharply 2-ribbed, red or green, tinged red, persisting semi-intact at upper nodes, weathering to thick, matted, pale fibers with much of the epidermis intact, drying reddish brown. LEAVES erect-spreading; *petioles* firm, flexible, 13.5–70 cm × 3–8 mm (dry), subterete, narrowly sulcate with thick, blunt, erect margins at base, becoming flattened with 3 ribs toward apex adaxially, rounded abaxially, dark green, faintly striate, semiglossy, drying dark reddish brown; geniculum 3-ribbed, to 1 cm, darker than petiole, drying darker than petiole, almost black, somewhat shrivelled; *blades* triangular-ovate, subcoriaceous, moderately bicolorous, abruptly acuminate at apex, deeply cordate at base, 18–59 × 10–31 cm, 1.4–1.9(–2.3)× longer than wide, 0.7–1.1(2.1)× longer than petiole, broadest ± at the middle, margins sometimes slightly concave at point of petiole attachment, otherwise rounded, adaxial surface semiglossy, dark green, drying dull, pale to dark red-brown, abaxial surface glossy, paler than adaxially, drying semiglossy, paler than adaxially; anterior lobe 16.5–41.5 × 10–31 cm, 2.3–4.3(–5.5)× longer than posterior lobes; posterior lobes 3–17 × 3.5–15 cm, rounded to obtuse, often bluntly acute at apex, directed downward, rarely slightly outward; sinus parabolic to spatulate to hippocrepiform, 1.5–16.5 cm deep; *midrib* broadly convex to flat to sunken, paler than blade, or matte and olive-green with short pale lineations adaxially, convex or round-raised and darker than blade abaxially, drying darker than blade on both surfaces; *primary lateral veins* 4 to 6 per side, 2–3.5 cm apart, spreading from midrib at 50°–60° angles, downturned at midrib, straight out to margin, drying nearly concolorous adaxially, darker or lighter than blade abaxially; interprimary veins sometimes nearly as prominent as primary lateral veins, more often obscure; *basal veins* 5 to 10 per side, with 1 to 4 free to base, 4 to 6 coalesced for 6.5 cm, posterior rib barely naked or naked to 2 cm, drying darker or lighter than blade abaxially; minor veins moderately obscure. INFLORESCENCE 2 per axil, erect or curved downward; *peduncle* 3–6.2 × 2–5 cm (dry), shorter than petiole, white and coarsely streaked at apex; *spathe* long-tapered, apiculate, 16–17.5 cm, slightly constricted above tube; spathe blade white outside, paler and glossy inside; spathe tube rosy burgundy, white-speckled toward blade outside, red-violet inside; *spadix* sessile, 12–15 cm; pistillate portion pale green, cylindrical, ca. 3.5 cm × 8 mm (dry); staminate portion ellipsoid, ca. 10 cm × 12 mm at widest point (dry), wider than pistillate and sterile staminate portions; sterile staminate portion cylindrical, to 4 cm × 7–8 mm (dry); *pistils* ca. 2 mm; *ovary* 6-locular, ovules with axile placentation, 10 to 20 per locule. INFRUCTESCENCE unknown. JUVENILE PLANTS differ in having leaf blades with smaller, less well-developed lobes.

Distribution and habitat. *Philodendron tricostatum* is endemic to Colombia and is known only from the western slopes of the Cordillera Occidental in the departments of Chocó and Valle. It occurs in Tropical wet forest (T-wf) and Tropical rain forest transition to Premontane (T-rf/P), at elevations below 150 m in dense primary or regrowth forests.

IUCN Red List category. Conservation for *Philodendron tricostatum* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), since it is known from six collections and has been found in both Chocó and Valle departments and many separate localities.

Phenology. *Philodendron tricostatum* has been collected in flower only in July.

Discussion. *Philodendron tricostatum* is a member of subgenus *Philodendron*, section *Philodendron*, subsection *Philodendron*, series *Fibrosa* and is characterized by the short internodes to 10 cm usually obscured by long, thick, matted, pale cataphyll fibers with large pieces of epidermis intact, and the triangular-ovate, deeply cordate leaf blades on slender petioles to 70 cm long. In addition, the inflorescences are stout, with a long apiculum, burgundy red on the spathe tube and white on the spathe blade. The light red-brown color when dry is also distinctive.

Paratypes. COLOMBIA. **Chocó:** Quibdó–Istmina rd., 14 km S of Quibdó, *Croat & Cogollo 52215* (MO); Km 31–32, S of Quibdó, *Croat 57370* (MO). **Valle:** Buenaventura–Málaga rd., Km 11, *Croat 69317A* (CUVC, MO); 6 km N of Km 22, Carretera Hanz, *Croat 69539* (CUVC, MO); Km 31.5, *Croat & Watt 70285* (CAS, G, GH, IMB, MEXU, MO, P, PMA, QCNE, SEL, TEX, UB, USM); Km 33.3, *Croat 61282* (COL, CUVC, F, MO, VEN), *61369* (HUA, JAUM, MO), *61372* (CUVC, MO, NY), *61388* (MO); Km 44, *Croat & Watt 70207* (MO); Km 52.4, *Croat & Bay 75727* (CUVC, MO); transect 4, *Gentry 35510* (MO); transect 6, *Gentry 35613* (MO); Bahia Málaga, vic. of Base Naval Málaga, along rd. to Buenaventura, ca. 1 km from base ca. Km 104, *Croat & J. F. Gaskin 80469* (CUVC, MO).

19. Philodendron trojitense Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Old Buenaventura–Cali rd., 14 km SE of Río Sabaletas, 53 km ESE of Queremal, steep rd. banks, 3°42′N, 77°51′W, 270 m, 10 Feb. 1990, *T. B. Croat & J. Watt 70457* (holotype, MO-3790223; isotypes, COL, K, US).

Planta terrestris aut hemiepiphytica; internodia 4–12 cm longa, 2–3.5 cm diam.; cataphylla usque ad 30 cm longa, acute 1-costata, decidua intacta. Folia erecto-patentia vel patentia; petiolus 17–52 cm longus, 5–9 mm diam. in sicco, subteres; lamina anguste triangulari-ovata, subcordata basi, 28–73 cm longa, 8–30 cm lata, hebetata infra, nervis lateralibus primariis utroque 9 vel 10, basalibus utroque 2, liberis usque ad basim. Inflorescentiae in quaque axilla usque ad 7; pedunculus 7–8 cm longus; spatha 8–13 cm longa, apiculata, lamina extus alba, suffusa rubra vel rubroviolacea, intus alba, tubo extus flavido-albo, intus atrovinaceo. Pistilla ca. 2 mm longa; ovarium 7- ad 9-loculare, loculis 1-ovulatis.

Terrestrial or hemiepiphytic; stem scandent or appressed-climbing; *internodes* 4–12 × 2–3.5 cm, longer than broad, medium green, transversely fissured, becoming brown and scurfy, drying brownish tan, transversely fissured; roots few per node, drying medium brown; *cataphylls* to 30 cm, sharply 1-ribbed, green, drying dark reddish brown, deciduous. LEAVES erect-spreading to spreading; *petioles* 17–52 cm × 5–9 mm (dry), subterete, dark green, short dark-lineate, drying olive-green to light brown; geniculum to 3 cm, drying darker than petiole and somewhat shrivelled; *blades* narrow triangular-ovate, moderately coriaceous, long-acuminate at apex, shallowly cordate at base, 28–73 × 8–30 cm, 2–3.5× longer than wide, 1.3–1.6× longer than petiole, adaxial surface semiglossy, dark green, drying semiglossy and olive-green, abaxial surface matte and much paler than adaxially, drying dull and barely paler than adaxially; sinus triangular to spatulate, 0.5–5 cm deep; *midrib* flat and yellowish white adaxially, narrowly rounded, paler than blade, short dark-lineate abaxially; *primary lateral veins* 9 to 10 per side, 3 cm apart toward base to 7.5 cm apart toward apex, spreading from midrib at 60°–70° angles, downturned at midrib, curving gradually out to margins, sunken and paler than blade, drying concolorous adaxially, convex and paler than blade, drying darker than blade, yellowish brown abaxially; *basal veins* 2 per side, both free to base; minor veins moderately distinct, arising mostly from the midrib. INFLORESCENCES to 7 per axil, enclosed in a prophyll; *peduncle* 7–8 cm × 2–5 mm (dry), medium green, faintly lineate; *spathe* apiculate (apiculum to 5 mm), 8–13 cm, slightly constricted above tube; spathe blade 5–6 cm, white, often with red to red-violet spots and tinged red along margin outside, burgundy toward base and white in upper 2/3 inside; spathe tube 3–5 cm, yellowish white outside, tinged red along margin, deep burgundy inside; *spadix* somewhat exserted at anthesis, sessile, slightly clavate, 9–11 cm; pistillate portion pale green, cylindrical, 1.5–2 cm long on one side, 2.4–3.5 cm long on the other side, 5–6 mm diam. (dry); staminate portion cream, clavate, 6.8–7.5 cm × 8–12 mm at widest point (ca. 1 cm from apex) (dry), broader than pistillate portion; sterile staminate portion not apparent; *pistils* ca. 2 mm; *ovary* 7- to 9-locular, ovules with basal placentation, 1 per locule. INFRUCTESCENCE unknown.

Distribution and habitat. *Philodendron trojitense* is endemic to Colombia and is known only from the Cordillera Occidental, in Valle Department. It occurs in Tropical rain forest transition to Premontane (T-rf/P), ranging in elevation from sea level to 270 m, growing along stream banks, road banks, or clambering over rocks.

IUCN Red List category. Conservation for *Philodendron trojitense* must be considered as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001). Although reasonably common in the area of the type locality, it is not yet known from other sites in Colombia. It is possible that the species is more widespread than is currently known because much of the Pacific slope is still poorly known.

Phenology. *Philodendron trojitense* was collected in flower from the Bajo Calima region in February and March.

Etymology. The species is named for the village of La Trojita, where the oldest known specimen was collected.

Discussion. *Philodendron trojitense* is a member of subgenus *Philodendron*, section *Macrobelium*, subsection *Glossophyllum*, series *Ovata* and is characterized by its scandent terrestrial habit; stems that are scurfy, brown, and transversely fissured; and long, narrow triangular-ovate leaf blades that are matte abaxially and have relatively few, widely spaced, primary lateral veins. In addition, the yellowish white, red-violet-spotted inflorescences grow in a cluster enclosed in a persistent prophyll.

Philodendron trojitense is somewhat similar to *P. suberosum* in that the epidermis of the stems of both species is highly fissured and they both have shallowly cordate leaf blades with all the basal veins free to the base. The latter species differs, however, in having leaf blades that are wider (1.3–1.8× longer than wide as compared to 2–3.5× longer than wide for *P. trojitense*) with more primary lateral veins much closer together. The inflorescences also differ because in *P. suberosum* they are shorter, more blunted at the apex, and solid dark red outside.

Paratypes. COLOMBIA. **Valle:** Bajo Calima region, La Trojita, *Cuatrecasas 16466* (F); old Buenaventura–Cali rd. via Queremal, 38 km beyond main hwy., Buenaventura–Cali, *Croat 57590* (CAS, MO, US); 14 km SE of Río Sabaletas, 53 km ESE of Queremal, *Croat & Watt 70457* (CAS, F, MO, NY).

20. Philodendron venulosum Croat & D. C. Bay, sp. nov. TYPE: Colombia. Valle: Buenaventura–Río Calima rd., 6.3 km N of Frente La Brea, Km 18, 6 km SE of San Isidro on Río Calima, 50 m, 4°02′N, 77°03′W, 7 July 1986, *T. B. Croat 61324* (holotype, MO-3490653; isotypes, COL, CUVC, K, US).

Planta hemiepiphytica aut terrestris; internodia 0.5–4 cm longa, 3–6 cm diam., in parte inferiore obtecta fibris cataphyllorum; cataphylla 16–35 cm longa, acute (raro obtuse) 2-costata, marronina vel rubroviolacea, in fibras robustas fatiscentia et persistentia. Folia erecta; petiolus 26.5–108 cm longus, teres vel obtuse subcomplanatus adaxialiter, interdum 1- vel 2-costata; lamina ovata, profunde cordata basi, 23–58.5 cm longa, 15–50 cm lata, nervis lateralibus primariis utroque 4 ad 8, basalibus utroque 7 vel 8, venulis transversalibus multis prominentibus. Inflorescentiae in quaque axilla 1 vel 2; pedunculus 17.5–23.5 cm longus; spatha 10–13.5 cm longa, lamina utrinque virenti, tubo extus virenti, interdum suffuso rubro. Pistilla 2.2–2.4 mm longa; ovarium 5- vel 6-loculare, loculis ca. 20-ovulatis.

Hemiepiphytic or terrestrial; stem appressed-climbing or scandent, sometimes upright to 80 cm; sap spicy; *internodes* 0.5–4 × 3–6 cm, usually longer than broad, medium green, semiglossy, drying golden tan to tan with flaking epidermis, lower portions obscured by cataphyll fibers; roots few to several per node, often highly branching, drying medium to reddish brown; *cataphylls* 16–35 cm, sharply 2-ribbed, rarely bluntly 2-ribbed, maroon to reddish violet or at least red at base, drying with very pale fibers and reddish brown epidermis attached, persisting semi-intact as robust sometimes wavy fibers with pieces of attached epidermis. LEAVES erect; *petioles* 26.5–108 cm, tapering from base to apex, from 0.4–1.3 cm diam. at the base to 2–5 mm diam. at the apex (dry), firm, terete to obtusely flattened adaxially, sometimes with 1 or 2 blunt ribs, slightly sulcate near base, pale to medium green, sometimes striate, drying dark olive-green, geniculum not obvious living or dried; *blades* ovate, subcoriaceous, obtuse, short-apiculate at apex, deeply cordate at base, 23–58.5 × 15–50 cm, 1.2–1.7× longer than wide, 0.5–0.8(–1)× as long as petiole, adaxial surface glossy, dark green, slightly bicolorous, drying glossy, dark reddish green, abaxial surface semiglossy, moderately paler than adaxially, drying shiny and barely paler than adaxially; anterior lobe 22.2–43 × 15–50 cm, 1.9–2.4(–2.8)× longer than posterior lobes; posterior lobes 6.5–22.5 × 7.5–27 cm, rounded on inside margin to rectangular on outside margin; sinus usually spatulate, 2.5–10.5 cm deep; *midrib* flat to sunken, paler or concolorous adaxially, narrowly rounded or convex, sometimes matte and darker than blade abaxially, usually drying darker than blade; basal veins 7 to 8 per side, 1 to 2 free to base, the remainder coalesced for 6 cm; posterior rib naked 1–2 cm; *primary lateral veins* 4 to 8 per side, 2–4 cm apart, spreading from midrib at 35°–55° angles, proceeding straight toward margin to within 1–2 cm then curving toward apex, downturned at midrib, obtusely sunken adaxially, convex abaxially; interprimary veins prominent but still less obvious than primary veins, drying darker than blade to concolorous, raised abaxially; cross veins numerous, drying with a stitched appearance toward margins. INFLORESCENCES erect, 1 to 2 per axil; *peduncle* 17.5–23.5 cm × 5–10 mm (dry), much shorter than petiole, medium green with a red base, somewhat white-streaked, drying dark to medium brown, somewhat red, longitudinally wrinkled; *spathe* 10–13.5 cm, moderately glossy, bluntly rounded at apex, somewhat constricted above tube; spathe blade 6–7.5 cm, medium green outside, paler inside; spathe tube 3.5–5.5 cm, dark green becoming greenish pink or tinged with red outside; *spadix* 9.5–11.5 cm; pistillate portion 2.3–4.5 cm, ca. 1.2 cm diam., white; staminate portion 7.5–10.5 × ca. 1.4 cm at base, ca. 1.7 cm diam. 1 cm from apex; sterile staminate portion 2.5–3.5 cm; *pistils* 2.2–2.4 mm;

ovary 5- to 6-locular, ovules with axile placentation, about 20 per locule. INFRUCTESCENCE to 13 cm, pistillate portion ca. 5 cm. JUVENILE PLANTS differ in having leaf blades that are oblong, rounded and not cordate at base, acuminate at apex, but soon developing a lobe at the base.

Distribution and habitat. *Philodendron venulosum* is endemic to Colombia and is known from the Cordillera Occidental, in the departments of Chocó and Valle. It occurs in Tropical wet forest (T-wf) and Tropical rain forest transition to Premontane (T-rf/P), ranging in elevation from 40 to 500 m, in dense forest.

IUCN Red List category. Conservation for *Philodendron venulosum* must be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001), since it is known from six collections and has been found in both Chocó and Valle departments and many separate localities.

Phenology. Both flowering and sterile specimens of *Philodendron venulosum* have been collected in March and July in the Bajo Calima region. A fruiting specimen was collected in July.

Discussion. The species is a member of subgenus *Philodendron*, section *Philodendron*, subsection *Philodendron*, series *Fibrosa* and is characterized by its large 2-ribbed cataphylls weathering to coarse fibers with pieces of attached epidermis, its long-tapered petioles, and glossy ovate-cordate blades with few primary lateral veins, but especially by the numerous fine cross veins for which it is named ("venulosum" from the Latin "venosus" meaning having many branched veins). Also characteristic are the bluntly rounded inflorescences with pale green spathe blades and rose-colored spathe tubes.

The species most likely to be mistaken for *Philodendron venulosum* is *P. striatum* because these two species can both grow terrestrially and have similarly shaped blades, few primary lateral veins, and short peduncles. The latter species, however, differs in having coarse white striations on the internodes, petioles, peduncles, and inside the spathe, as well as unribbed cataphylls that weather to thin fibers. *Philodendron striatum* also differs in having blades that are matte on the abaxial surface (rather than glossy) and long-tapered inflorescences with spathe tubes that are yellow-green outside.

Paratypes. COLOMBIA. **Chocó:** Quibdó–Bolívar, 97 km E of Quibdó, *Croat 57284* (MO). **Valle:** Buenaventura–Río Calima rd., 6.3 km N of Frente La Brea, Km 18, 6 km SE of San Isidro on Río Calima, *Croat 61341* (COL, MO); Buenaventura–Málaga, Carretera Hanz, Km 6.5, *Croat 71132* (B, MO, NY); Dindo area, *Gentry & Monsalve 48428* (CUVC, MO); Buenaventura–Málaga rd., Km 49, *Croat & Bay 75806* (CUVC, MO); Km 51.7, *Croat & Bay 75782* (MO); old Buenaventura–Cali rd., 20 km beyond turnoff from main Cali–Buenaventura hwy., *Croat 57566* (MO); 12 km S of Sabaletas, *Croat & Watt 70446* (MO); Yatacué, Alto Anchicaya, *Gentry & Monsalve 48215* (CUVC); vic. of Bahia Málaga, Base Naval Málaga, Río Bongito, *Croat & Gaskin 80561* (CUVC, HUA, MO), *80562* (CUVC, MO).

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Two New Species with Pendulous Fruits in *Hesperis* (Brassicaceae) from South Anatolia, Turkey

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ABSTRACT. Two new species, *Hesperis anatolica* A. Duran and *H. hamzaoglui* A. Duran (Brassicaceae), are described and illustrated from Anatolia, Turkey. *Hesperis anatolica* grows in serpentine pebbly slopes and open pine forest and scrub in Pozantı and Karsantı (Adana province). It is closely related to *H. persica* Boissier, an endemic confined to South Anatolia. *Hesperis hamzaoglui* grows in granitic rocky sites in a forest-steppe ecotone from Zorkun Yayla (Osmaniye province). It is closely related to *H. podocarpa* Boissier, an endemic confined to the Amanos Mountains. Diagnostic morphological characters are discussed, as well as the ecology, biogeography, and conservation status of both new species. In addition, the pollen characteristics and seed coat surface of *H. anatolica*, *H. persica*, *H. hamzaoglui*, and *H. podocarpa* are examined by SEM. *Hesperis anatolica* is diploid with a new report of the chromosome number of $2n = 12$.

Key words: Brassicaceae, Cruciferae, *Hesperis*, IUCN Red List, Matthioleae, Turkey.

The genus *Hesperis* L. (Brassicaceae) is distributed in the warm climate belt of Eurasia in South and Central Europe, southwest Asia, the Caucasus, Russia, and mountainous regions of western China and Mongolia. This genus has almost 56 species throughout the world (Fournier, 1866; Tzvelev, 1959; Dvořák, 1980; Duran et al., 2002, 2003; Duran & Ocak, 2005; Al-Shehbaz et al., 2006). Most species in Anatolia are confined to rather restricted areas of distribution. On the other hand, those occurring in moist areas are more widespread, especially in the Euro-Siberian phytogeographic region.

Hesperis is represented by many taxa in Anatolia, which is the junction of the Irano-Turanian, Mediterranean, and Euro-Siberian phytogeographic regions. Toward the outer boundaries of these phytogeographic regions, *Hesperis* is represented by fewer taxa. The number of *Hesperis* taxa in different floras also supports this view. *Hesperis* is represented by 14 species in Europe (Ball, 1964), 11 species in Iran (Dvořák, 1968), nine species in Romania (Săvulescu, 1955), five species in Iraq (Dvořák, 1980), three species in Italy (Pignatti, 1982), one species in Palestine (Zohary, 1966), and 27 species in Turkey (Duran et al., 2003; Duran & Ocak, 2005).

Dvořák carried out morphological, cytological, and palynological studies on *Hesperis* species (Dvořák, 1964, 1966a, b, 1973; Dvořák & Dadakova, 1974), described new *Hesperis* taxa, and revised the genus *Hesperis* for both the *Flora of Iraq* and *Flora Iranica* (Dvořák, 1968, 1980).

Characters used in the systematics of the Brassicaceae are evaluated, and some problems relating to various genera and tribes are discussed. The tribe Hesperideae is unigeneric, consisting of the genus *Hesperis*. The tribe is readily distinguished from the rest of the Brassicaceae by having stalked glands with uniseriate stalks terminating in a unicellular gland. Multicellular stalked glands occur in the Chorisporeae and Anchonieae, but in these tribes the stalks are multiseriate and the glands are multicellular (Al-Shehbaz et al., 2006).

The genus *Hesperis* was revised by Cullen (1965) to include 21 species for the *Flora of Turkey*. Seven new species have since been described from Turkey, as well as four newly recorded from Turkey (Davis et al., 1988; Duran & Ocak, 2005; Parolly & Tan, 2006). In this paper, *H. anatolica* A. Duran and *H. hamzaoglui* A. Duran are described as two new species, bringing the total number of *Hesperis* species for Turkey to 34.

The author collected some interesting *Hesperis* specimens with flowers and fruit on botanical trips to the Amanos Mountains (Osmaniye province) and Toros Mountains (Adana province) in the 1999 and 2003 growing seasons. The specimens were not referable to any known *Hesperis* species. Studying the specific descriptions of *Hesperis* in Ball (1964), Busch (1939), Cullen (1965), Davis et al. (1988), Dvořák (1968, 1980), Halácsy (1900), Hayek (1927), Pignatti (1982), Săvulescu (1955), Tan and Iatrou (2001), Tzvelev (1959), Zohary (1966), and Duran and Ocak (2005), as well as comparison with specimens in the herbaria AEF, ANK, BM, E, GAZI, HUB, ISTF, K, KNYA, MSB, P, VANF, and WU, showed that the specimens represent two species new to science. The full list of examined representatives of *H. podocarpa*

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Boissier, *H. cappadocica* E. Fournier, *H. pendula* DC., and *H. persica* Boissier is available from the author.

Material and Methods

Specimens belonging to both new species were collected both with flower and with fruit from the type locality. Each numeric value is the average of 10 measurements from different specimens.

For palynological studies, pollen samples were taken from the specimens at herbarium KNYA and prepared for light microscopy (Wodehouse, 1935), with descriptive terminology from Faegri and Iversen (1975). Measurements on a Nikon E600 (Nikon Corporation, Tokyo, Japan) microscope were based on 50 samples or more for pollen diameter and ca. 10 samples for other features. For SEM studies, pollen grains were hydrated with 10% KOH for ca. 10 min., then rinsed with distilled water and dried before mounting and sputter coating with gold for SEM micrographs with a JSM-5600 (JEOL Ltd., Tokyo, Japan) microscope. SEM micrographs for seed morphology were similarly taken and the descriptive terminology of Brochmann (1992) followed.

For the study of somatic chromosomes, root tips were obtained from germinated seeds, which were pretreated in α-monobromonaphthalene overnight and then fixed in alcohol:acetic acid (3:1). Roots were hydrolyzed in 1N HCl at 60°C for 16 min. and Feulgen stained, and squashes were made in 1% lactopropionic orcein. Permanent slides were made in Depex. Chromosome numbers were based on at least five metaphase plates.

Species of *Hesperis*

1. Hesperis anatolica A. Duran, sp. nov. TYPE: Turkey. Adana: Pozantı, betw. Hamidiye–Karakuz (Çamlıbel), 4 km, serpentine pebbly slopes, open *Pinus* forest, scrub, 1400 m, 37°32.30′N, 34°00.38′E, 16 May 1999, *A. Duran 4498* (holotype, KNYA; isotypes, ANK, E, GAZI, HUB). Figure 1.

Affinis *Hesperidi persicae* Boissier sed ab ea caulibus pilis glandulosis (non plerumque simplicibus) pubescentibus, foliis semi-carnosis spathulatis usque lyratis (non oblongis usque oblanceolatis), petalis 13–17.5 mm (non 18–22.5 mm) longis, siliquis pilis glandulosis indutis (non plerumque glabris) atque seminibus 3.4–4 mm (non 2.4–3.4 mm) longis differt.

Biennial herb; roots thickened, 2.5–6(–9) mm diam.; stems ascending, 25–40(–55) cm, generally purplish below and greenish above, sometimes entirely purplish, often solitary or rarely 2, richly branched at base, terete, smooth, 2–7 mm diam. below, pubescent with densely stalked short glandular and sometimes a few long simple hairs below, 1.7–2.2 mm. Leaves crowded on lower and middle stems, semifleshy, partly purplish especially in lower leaves; basal leaves spatulate to lyrate, 4–10(–16) × 1–2(–3.5) cm (including petiole), remotely denticulate, rarely undulate, irregularly coarsely toothed below, terminal segments ± circular; petiole 1.5–3(–6) cm, sharply narrower at base, ± obtuse, all with main midrib conspicuous, purplish, with indumentum of mostly stalked glandular hairs, sparsely simple and bifurcate hairs, and bifurcate hairs especially at margin; cauline leaves acropetally decreasing, indumentum similar to basal leaves, sometimes bifurcate hairs absent; middle cauline leaves spatulate, lyrate, or broadly oblong, petiolate, mostly suddenly narrowed into petiole, sinuate, remotely denticulate to coarsely toothed below, obtuse or ± acute; upper cauline leaves broadly ovate to oblanceolate, short petiolate or sessile, somewhat cordate, sinuate or irregularly denticulate, obtuse or ± acute. Inflorescence a raceme, branches ascending, 20–30(–40) × 15–20(–30) cm; pedicels ascending at flowering, deflexed immediately after anthesis, slender, 3–4 mm at anthesis, elongating to 7 mm in fruit, with glandular hairs. Flowers ebracteate; sepals pinkish to violet, somewhat greenish below, oblong, deciduous, with 6 to 9 veins, 6–8 × 2–2.8 mm, with short glandular hairs, long simple hairs on tips, rarely a few bifurcate hairs, with membranous margins, inner sepals strongly saccate. Petals spatulate to obovate, 13–17.5 × 4.3–6 mm, pinkish to violet, veins inconspicuous; limb obovate to orbicular, suddenly narrower into the claw, 5.5–8 × 4.3–6 mm, obtuse, mostly horizontal, and rarely slightly deflexed; claw 7–10 × ca. 1.7 mm, claw clearly exserted from sepal; outer filaments not dilated at base, 2.8–3.1 mm, inner filaments dilated at base, 4.4–5.1 mm, whitish or ± pinkish; anthers all fertile, ± linear, 2–2.6 mm, yellowish or greenish, basifixed; stigma with 2 obtuse, decurrent carpidial lobes; ovary often with hairs. Fruiting pedicels slightly thickened, 0.7–1.1 mm diam.; fruits (25–)55–90(–110) × 1.8–3.1 mm, terete, dehiscent, somewhat indehiscent on tips, slightly torulose, straight or slightly curved, pendulous, pubescent stalked glandular and very rarely a few long simple hairs, greenish to yellowish, or partly purplish; valves slightly broader than septum; septum membranous at seed, semimembranous or ± spongiose elsewhere, with invisible median veins; seeds brown, 3.4–4 × 1–1.4 mm, 2 to 14 in number.

Distribution and habitat. *Hesperis anatolica* appears to be endemic to South Anatolia (Adana province in Turkey) and belongs in the East

Figure 1. *Hesperis anatolica* A. Duran. —A. Habit. —B. Fruit. Drawn from the holotype *Duran 4498* (KNYA).

Mediterranean floristic element. The specimens were collected in Adana province, where the species appears to be rare and local. *Hesperis anatolica* grows in serpentine pebbly slopes, with open *Pinus* forest and scrub with *P. brutia* Tenore, *P. nigra* Arnold, *Juniperus excelsa* M. Bieberstein, *Aethionema speciosum* Boissier & Huet, *Alyssum desertorum* Stapf, *Erysimum thyrsoideum* Boissier, *Papaver tauricola* Boissier, *Silene aegyptiaca* (L.) L. f., *Cicer pinnatifidum* Jaubert & Spach, *Cistus laurifolius* L., *Scandix pecten-veneris* L., *Vincetoxicum tmoleum* Boissier, *Salvia cryptantha* Montbret & Aucher ex Bentham,

Ziziphora capitata L., *Asphodeline lutea* (L.) Reichenbach, *Quercus cerris* L., *Q. pubescens* Willdenow, *Aegilops biuncialis* Visiani, and *Dactylis glomerata* L., from 800 to 1800 m in altitude.

IUCN Red List category. Although the type population is not in good condition, its distribution extends to two localities in Adana province (Pozantı and Karsantı) in Turkey. Its leaves and flowers have been subject to grazing by animals for many years, and therefore in areas of both localities the species is under threat. In my opinion, *Hesperis anatolica* should be considered Endangered (EN) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Hesperis anatolica* has been found flowering in May and June, and fruiting in June and July.

Seed and pollen morphology. The seed coat surfaces of *Hesperis anatolica* and *H. persica* are similar in the reticulate-verrucate ornamentation (Fig. 2), but otherwise differ. In *H. anatolica*, the reticulum wall is thin (3.9–4.7 μm), slightly moniliform, with undulations traversing the interspaces, and the muri are pentagonal lengthwise (*A. Duran 4959*). In *H. persica*, the reticulum wall is thick (8–8.3 μm), with undulations traversing the interspaces, a pentagonal shape to the muri, and with equilateral sides (*A. Duran 4707*).

Pollen of *Hesperis anatolica* and *H. persica* are similar in both shape and size, and are generally stable (Table 1, Fig. 3). Although the aperture type of *H. anatolica* is generally syncolpate, it is tricolpate in *H. persica*.

Discussion. *Hesperis anatolica* is related to *H. persica*, but differs mainly in its stems with mostly glandular hairs (vs. mostly simple hairs); the semifleshy leaves with mostly stalked glandular, sparsely simple and bifurcate hairs (vs. not semifleshy, with long simple and short glandular hairs); the spatulate to obovate petals, 13–17.5 × 4.3–6 mm (vs. oblanceolate, 18–22.5 × 3.5–4.5 mm); the fruits with stalked glandular hairs (vs. glabrate); and the seeds 3.4–4 mm long (vs. 2.4–3.4 mm). Diagnostic characters comparing *H. anatolica* and *H. persica* are provided in Table 2.

Another similar species, *Hesperis borbasii* Dvořák, grows naturally and is endemic to Iran. *Hesperis borbasii* is quite similar to *H. persica*, but principally differs in its entirely glabrous form.

Hesperis podocarpa is readily distinguished from *H. anatolica* by its stems mostly tufted, with dense, long simple hairs. The basal leaves are oblong or oblanceolate, entire, sinuate, and slightly lyrate-pinnatifid, with mostly long simple, short glandular hairs; the pedicels are ascending to erect at anthesis, ± graceful, slender, 2.5–10 mm long at anthesis, to 13 mm; the sepals are 7–10 mm long; the petals are 19–25 mm long, and deep violet or mauve in color; the ovary is glabrous; and the fruits are 1.2–2 mm wide, indehiscent, glabrous at maturity, with the septum membranous at seed attachment, and more abundantly developing spongiose matter between the seeds. *Hesperis podocarpa* is distributed only in Gaziantep and Hatay provinces and is endemic to Turkey; it is related to *H. persica* (Duran et al., 2003).

The semifleshy leaves of *Hesperis anatolica* are noted for the first time in the genus, and this leaf character is a reliable diagnostic feature (Busch, 1939; Ball, 1964; Cullen, 1965; Dvořák, 1968; Davis et al., 1988; Duran et al., 2003).

Paratypes. TURKEY. **Adana:** Pozantı, betw. Hamidiye–Karakuz (Çamlıbel), 4 km, 1400 m, 37°32.30′N, 34°00.38′E, 24 July 1999, *A. Duran 4959 & Hamzaoğlu* (KNYA, MO), 20 June 2000, *A. Duran 5335 & Sağıroğlu* (KNYA), 2 July 2001, *A. Duran 5722 & Sağıroğlu* (KNYA); Pozantı, betw. Hamidiye–Karakuz (Çamlıbel), 880 m, 16 May 1999, 37°30.91′N, 35°01.85′E, *A. Duran 4500 & Adıgüzel* (KNYA); E of Pozantı, 1000–1100 m, 3 May 1990, *H. Duman 4524* (GAZI); Karsantı, Pos ormanı, Şamadan bölgesi, Deveçökeği mevkii, ca. 1230 m, 1 June 1973, *E. Yurdakulol 1323* (ANK); Karsantı, Soğukoluk KB sırtı, Faraşa yolu, ca. 1420 m, 14 June 1972, *E. Yurdakulol 17* (ANK); Karsantı, Hızar bölgesi, Hızar gediği, ca. 1800 m, 1 June 1973, *E. Yurdakulol 1326* (ANK).

2. Hesperis hamzaoglui A. Duran, sp. nov. TYPE: Turkey. Osmaniye: Amanos Mtn., Zorkun, Keldazı hill, 1750 m, 36°58.95′N, 36°24.22′E, 20 May 2001, *A. Duran 5694 & Hamzaoğlu* (holotype, KNYA; isotypes, ANK, E, GAZI, HUB). Figure 4.

Affinis *Hesperidi podocarpae* Boissier, sed ab ea plantis 13–28 cm (non 20–70 cm) altis, caulibus pilis glandulosis (non hispidis) dense pubescentibus, foliis basalibus anguste spathulatis et irregulariter denticulatis (non lyratis, pinnatilobis usque pinnatisectis et infra grosse dentatis), petalis 17–21 cm (non 19–25 cm) longis, siliquis pubescentibus (non glabris) differt.

Perennial herb; roots thickened, 3–8(–12) mm diam.; stem ± erect, 13–20(–28) cm, sometimes purplish below, solitary or rarely 2 to 6, mostly branched with flowering part ± terete, smooth, 2–5 mm diam. below, pubescent with densely stalked glandular hairs, 0.2–0.3 mm, rarely a few long simple hairs 1.6–2 mm above. Leaves crowded especially on lower stems, these ± swollen, closely overlapping; basal leaves narrowly spatulate to oblanceolate, 3–6 (–10) × 0.5–1.2(–2) cm (including petiole), irregularly dentate to denticulate, petiole 1–2 cm, lamina of radical leaves attenuate into basal petiole, obtuse or ± acute, all with main midrib ± conspicuous, with

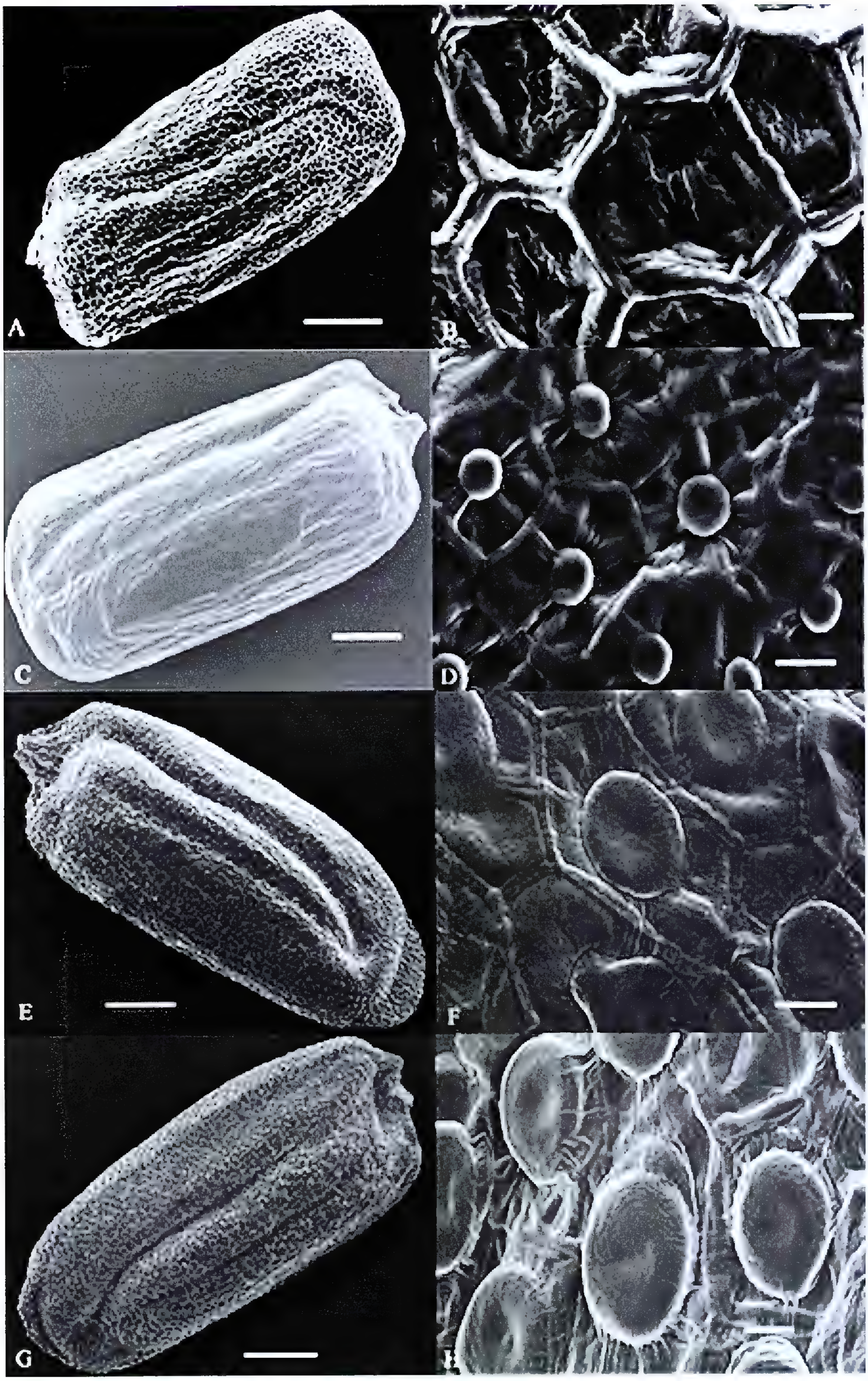

Figure 2. SEM images of seed coat surfaces. —A, B. *Hesperis hamzaoglui* (*A. Duran 5758*, KNYA). —C, D. *H. podocarpa* (*A. Duran 5317*, KNYA). —E, F. *H. anatolica* (*A. Duran 4959*, KNYA). —G, H. *H. persica* (*A. Duran 4707*, KNYA). Scale bars: A, C, E, G = 500 μm, B, D, F, H = 20 μm.

indumentum of mostly stalked glandular hairs or a few long simple hairs, rarely a few bifurcate hairs; cauline leaves of similar size at midstem, or acropetally decreasing, indumentum similar to basal leaves, narrowly oblong to oblanceolate, short petiolate or subsessile, attenuate into petiole, remotely ± denticulate or entire, obtuse or subacute; upper cauline leaves narrowly oblong, oblanceolate, or lanceolate,

Table 1. Pollen morphology of *Hesperis anatolica*, *H. hamzaoglui*, *H. persica*, and *H. podocarpa*.

Species	Polar axis (μm)	Equatorial axis (μm)	Pollen shape	Intine thickness (mean) (μm)	Exine thickness (mean) (μm)	Ornamentation			Aperture type
						Shape	Muri width (mean) (μm)	Lumina width (mean) (μm)	
H. anatolica	23.0–25.2	21.2 -22.9	subprolate	0.3	2.0	reticulate	0.75	1.75	syncolpate
H. hamzaoglui	15.3–16.7	11.6–12.8	subprolate	0.5	1.7	reticulate	0.25	1	syncolpate
H. persica	20.6–21.4	20.0–20.8	prolate-spheroidal	0.5	1.6	reticulate	0.75	1.25	tricolpate
H. podocarpa	17.4–18.5	17.1–18.3	prolate-spheroidal	0.3	1.3	reticulate	0.35	1.25	tricolpate

sessile, subentire or minutely denticulate, ± acute to acuminate. Inflorescence a raceme, branches ± erect, 6–13(–18) × 3–10 cm; pedicels ascending, slender, 4–15 mm at anthesis, elongating to 22 mm in fruit, with mostly stalked glandular, a few simple, or rarely bifurcate hairs. Flowers ebracteate; sepals pinkish to violet, somewhat green below, oblong, deciduous, with 7 to 8 veins, 6.5–10.5 × 2–2.7 mm, bifurcate, simple and glandular hairs, with membranous margins, inner sepals strongly saccate; petals obovate to lanceolate, 17–21 × 4–6.5 mm, deep violet, veins conspicuously darker violet; limb oblong to obovate, tapering gradually into the claw, 8–10 mm, ± obtuse, ± horizontal or slightly deflexed; claw 8–11 × 1.6–2 mm, claw clearly exserted above sepal; outer filaments not dilated at base, 3–4 mm, inner filaments dilated at base, 5.8–6.6 mm, ± purplish above; anthers all fertile, ± linear, 2.6–3.9 mm, yellowish, basifixed; stigma with 2 obtuse, decurrent carpidial lobes; ovary often with hairs; fruiting pedicels slightly thickened, 0.5–0.8 mm diam.; fruits (25–)40–70(–90) × 1.4–2 mm, terete, ± indehiscent, ± torulose, slightly curved or straight, pendulous at maturity, completely or at least in lower part pubescent with ± short glandular and sometimes simple and bifurcate hairs, greenish to yellowish, partly or completely purplish green; valves broader than septum; septum membranous only at seed, abundantly developing spongiose matter elsewhere, with visible median veins; seeds light brown, 2.7–3.4 × 1–1.2 mm, 2 to 12 in number.

Distribution and habitat. *Hesperis hamzaoglui* appears to be endemic to the area Zorkun Yayla (Osmaniye, Turkey), South Anatolia, and belongs in the East Mediterranean florisitic element. The new species grows in granitic rocky sites within the forest-steppe ecotone with *Cedrus libani* A. Richard, *Berberis crataegina* DC., *Fagus orientalis* Lipsky, *Alyssum oxycarpum* Boissier & Balansa, *Thurya capitata* Boissier & Balansa, *Silene spergulifolia* (Willdenow) M. Bieberstein, *Genista albida* Willdenow, *Cytisopsis dorycniifolia* Jaubert & Spach, *Ferula elaeochytris* Korovin, *Salvia tomentosa* Miller, *S. cryptantha*, *Silene doganii* A. Duran & Menemen, *Scorzonera yildirimlii* A. Duran & Hamzaoğlu, and *Rhabdosciadium oligocarpum* (Post ex Boissier) Hedge & J. M. Lamond, from 1700 to 1800 m altitude (Duran & Menemen, 2003; Duran & Hamzaoğlu, 2004).

IUCN Red List category. The specimens were collected in Osmaniye province in Turkey, where the species seems to be very rare and local, from an area of ca. 2.5 acres. The population is not in good condition, with approximately 120 specimens. Therefore, it should be considered Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001).

Phenology. *Hesperis hamzaoglui* has been found flowering in May and June, and fruiting in June and July.

Etymology. The new species is named in honor of the Turkish botanist and professor Ergin Hamzaoğlu (Biology Department, Bozok University, Yozgat).

Seed and pollen morphology. The seed coats of *Hesperis hamzaoglui* and *H. podocarpa* were studied by SEM and differ in surface detail. The seed surface ornamentation in *H. hamzaoglui* is reticulate-verrucate (Fig. 2); the reticulum wall is thick (9.1–9.7 μm), with undulations traversing the interspaces, and it is polygonal in shape. In the lumen the wart is absent (*A. Duran 5758*). The seed surface ornamentation in *H. podocarpa* is reticulate-verrucate (Fig. 2); the reticulum wall is thin (4–4.7 μm), with traverse undulations and polygonal in shape (*A. Duran 5317*). *Hesperis hamzaoglui* has a thicker reticulum wall than *H. podocarpa*, but lacks the central wart situated in the lumen of *H. podocarpa* (Fig. 2).

SEM analysis showed that *Hesperis hamzaoglui* and *H. podocarpa* are dissimilar in their pollen characteristics (Table 1, Fig. 3). Although the aperture type of *H. hamzaoglui* is generally syncolpate, it is tricolpate in *H. podocarpa*.

Discussion. *Hesperis hamzaoglui* is closely related to *H. podocarpa* (cf. Table 2), but differs in the stems with densely glandular hairs (vs. hispid, mostly mixed

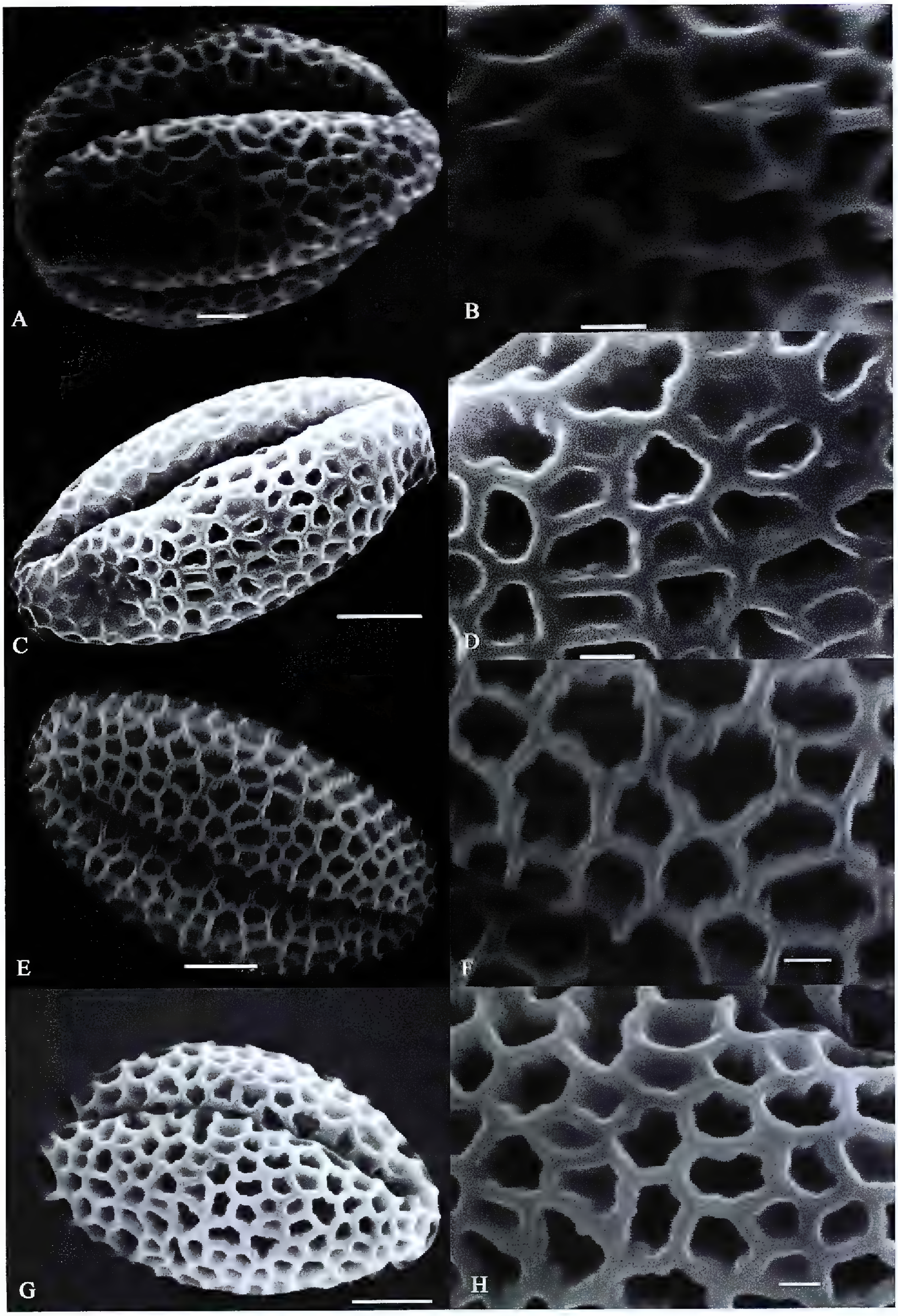

Figure 3. SEM images of pollen grains. —A, B. *Hesperis hamzaoglui* (*A. Duran 5694 & Hamzaoğlu*, KNYA). —C, D. *H. podocarpa* (*A. Duran 5031*, KNYA). —E, F. *H. anatolica* (*A. Duran 4498*, KNYA). —G, H. *H. persica* (*A. Duran 5198*, KNYA). Scale bars: A = 2 μm, C, E, G = 5 μm, B, D, F, H = 1 μm.

hairs); the leaves mostly glandular-pubescent (vs. long simple, short glandular, and sometimes bifurcate hairs); the basal leaves narrowly spatulate to oblanceolate, 3–6 cm long, and entire or irregularly dentate (vs. oblong, oblanceolate, lyrate, pinnatilobed to pinnatisect); the pedicels with mostly stalked glandular hairs (vs. glabrous or mixed hairs); and the pubescent fruits (vs. glabrous). *Hesperis podocarpa*

Table 2. Diagnostic characters of the new species *Hesperis hamzaoglui* and *H. anatolica* with the related *H. persica* and *H. podocarpa*. Character states are taken from Cullen (1965), Dvořák (1968), and Davis et al. (1988).

Diagnostic characters	*H. podocarpa*	*H. hamzaoglui*	*H. anatolica*	*H. persica*
Life form	perennial	perennial	biennial	biennial or perennial
Stems	20–70 cm tall, mostly tufted, ± erect	13–20 cm tall, mostly solitary, ± erect	25–55 cm tall, mostly solitary, ascending	30–85 cm tall, mostly tufted, ascending to erect
Stem pubescence	generally hispid, with densely simple and sparsely glandular hairs or only simple hairs	not hispid, with entirely densely stalked glandular hairs	not hispid, but densely stalked glandular and sometimes a few long simple hairs below	sometimes slightly hispid, mostly long simple hairs
Leaves	not semifleshy, with long simple, short glandular, and sometimes bifurcate hairs	not semifleshy, with mostly stalked glandular hairs	semifleshy, with mostly stalked glandular, sparsely simple, and bifurcate hairs	not semifleshy, with long simple and short glandular, rarely a few bifurcate hairs
Basal leaves	5–10 × 0.5–2 cm, oblong, oblanceolate, lyrate, pinnatilobed to pinnatisect, irregularly coarsely toothed below	3–6 × 0.5–1.2 cm, narrowly spatulate to oblanceolate, entire or irregularly dentate to denticulate	4–10 × 1–2 cm, spatulate to lyrate, terminal segments ± circular	10–18 × 1–2.5 cm, oblong to oblanceolate
Petiole length	2–6 cm	1–2 cm	1.5–3 cm	4–8 cm
Pedicel	± graceful, 2.5–10 mm at anthesis, elongating to 13 mm and finally deflexed, glabrous, bifurcate, or glandular and simple hairs	4–15 mm at anthesis, elongating to 22 mm in fruit and finally deflexed, with mostly stalked glandular hairs	3–4 mm at anthesis, elongating to 7 mm in fruit and deflexed immediately after anthesis, with glandular hairs	2–5 mm at anthesis, elongating to 9 mm and finally deflexed, mixed hairs or ± glabrous
Sepals	pinkish to violet, somewhat partly greenish, 7–10 mm	pinkish to violet, greenish below, 6.5–10.5 mm	pinkish to violet, 6–8 mm	partly purplish, 7–10 mm
Petals	19–25 mm, obovate to lanceolate, deep violet or mauve	17–21 mm, obovate to lanceolate, deep violet	13–17.5 mm, spatulate to obovate, pinkish to violet	18–22.5 mm, oblanceolate, purple-brown, reddish or yellow, violet, deep purple, or chocolate brown
Limb	obovate to oblanceolate, tapering gradually into the claw	oblong to obovate, tapering gradually into the claw	obovate to orbicular, suddenly narrower into the claw	obovate, tapering gradually into the claw
Ovary	glabrous	often with pubescence	pubescent	mostly glabrous, rarely asperulous
Fruits	1.2–2 mm wide, terete, glabrous, with median veins not visible	1.4–2 mm wide, terete, indehiscent, completely or at least lower part pubescent, with visible median veins	1.8–3.1 mm wide, terete, dehiscent, somewhat indehiscent on tips, pubescent, with median veins not evident	2–2.8 mm wide, slightly flattened to terete, dehiscent, glabrous or with short simple hairs, with ± visible median veins
Seed length	3–4.2 mm	2.7–3.4 mm	3.4–4 mm	2.4–3.4 mm
Reticulum wall of seed coat	thin (4–4.7 μm)	thick (9.1–9.7 μm)	thin (3.9–4.7 μm)	thick (8–8.3 μm)
Pollen shape	prolate-spheroidal	subprolate	subprolate	prolate-spheroidal
Aperture type	tricolpate	syncolpate	generally syncolpate	tricolpate

Figure 4. *Hesperis hamzaoglui* A. Duran. —A. Habit. —B. Fruits. Drawn from the holotype *Duran 5694 & Hamzaoğlu* (KNYA).

grows naturally in Turkey and is a local endemic, with an allopatric distribution in relation to *H. hamzaoglui*. Diagnostic characters comparing *H. hamzaoglui* and *H. podocarpa* are provided in Table 2.

Hesperis persica is distinguished from *H. hamzaoglui* by characteristics listed in Table 2. The former species is distributed in Turkey, Iran, Iraq, and Azerbaijan, and is morphologically related to *H. hamzaoglui*.

Paratypes. TURKEY. **Osmaniye:** Amanos Dağları, Zorkun yaylası, Keldazı tepesi, 1750 m, 36°58.95′N, 36°24.22′E, 17 June 2000, *A. Duran 5285 & Hamzaoğlu* (KNYA, MO), 5 July 2001, *A. Duran 5758* (KNYA), 5 July 2003, *A. Duran 6280 & Sağıroğlu* (KNYA).

Taxonomy. Only five species of the genus *Hesperis* have pendulous fruits: *H. persica*, *H. borbasii*, *H. podocarpa*, *H. pendula*, and *H. cappadocica* (Busch, 1939; Ball, 1964; Cullen, 1965; Dvořák, 1968; Davis et al., 1988; Duran et al., 2003). *Hesperis cappadocica* from section *Contorta* (Dvořák) A. Duran has fruits 3–7 mm wide that are dorsally flattened, dehiscent, with toothed margins, and contorted. In *H. pendula*, the stem has long or short simple and short glandular hairs; the leaves have mostly long simple, or short glandular and bifurcate hairs; the pedicels are 1.5–2.5 mm at anthesis, elongating to 4 mm, and densely pubescent; the petals are oblong-obovate, 16.5–22(–25) × 3–5(–8) mm, yellowish, varying in part from light purple to brownish purple, purplish or violet, or violet to pinkish; the ovary is densely pubescent; and the fruits are 25–70 × 2.2–3.5 mm, ± dehiscent, and densely pubescent (Ball, 1964; Cullen, 1965; Dvořák, 1968, 1980; Davis et al., 1988; Duran et al., 2003).

Fournier (1866) transferred the species in section *Deilosma* Andrásovszky into the newly described species in section *Pachycarpos* E. Fournier on the basis of their fruit characteristics. Section *Pachycarpos* is mainly characterized by its indehiscent fruits. Tzvelev (1959) extended the description of the section *Pachycarpos* by including the characteristics of somewhat dehiscent fruits into the section. Fournier (1866) and Tzvelev (1959) categorized the infrageneric classification of *Hesperis* species into three sections: *Hesperidium* DC., *Deilosma*, and *Pachycarpos*. The new species *H. hamzaoglui* and *H. anatolica* are both included in section *Pachycarpos*.

Cytology. Chromosome numbers of *Hesperis* taxa are reported as $n = 6, 7, 8, 12, 14, 16, 20, 24$, and $2n = 12, 14, 16, 24, 28$ (Dvořák & Dadáková, 1974; Khosravi & Maassoumi, 1998; Warwick & Al-Shehbaz, 2006). Chromosome counts for *H. anatolica* reveal a diploid count of $2n = 12$, a new report, which corresponds to the base number for section *Pachycarpos*. Chromosome numbers in related species in section *Pachycarpos* are $2n = 12$ in *H. pendula* and *H. persica*, which also have pendulous fruits. A chromosome count for *H. hamzaoglui* was not possible due to the mucilage layer that covered the seeds, which negatively affected seed germination (Martin, 2003).

Biogeography. The Cilician Taurus mountain range occupies the intersection of the Mediterranean and Irano-Turanian phytogeographic regions, lying also on the Anatolian Diagonal. The Amanos mountain range is also biogeographically significant, occupying an intersection of the Mediterranean phytogeographic region and the Anatolian Diagonal, with many Euro-Siberian phytogeographic region enclaves (Atalay, 1994). This transition zone north and south of the Amanos Mountains is a restricted area where the Euro-Siberian floristic elements spread to the west. The Euro-Siberian flora is very poor in endemic taxa, most of the elements being widely distributed species, and is strongly influenced by Mediterranean elements. Therefore, the enclave flora of the Amanos Mountains is fairly rich and relictual, with local, regional, and paleoendemic taxa. These taxa include *Galatella amani* (Post) Grierson, *Prangos turcica* A. Duran, M. Sağıroğlu & H. Duman, *Silene doganii*, *Scorzonera yildirimlii*, *Draba haradjianii* Rechinger f., and *Cephalaria amana* Rechinger f. (Duran & Menemen, 2003; Duran & Hamzaoğlu, 2004; Duran & Ocak, 2005; Duran et al., 2005). Of 13 *Hesperis* species (including the two new taxa) found in the Anatolian Diagonal, nine are endemic in Turkey (Cullen, 1965; Davis et al., 1988; Duran et al., 2003; Duran & Ocak, 2005). The concept of the Anatolian Diagonal was proposed by P. H. Davis (1971), who defined it as an oblique belt running from the northeast, south to the Anti-Taurus Mountains where it then divides, with one branch to the Amanos Mountains (Amanos Dağları) and the other to the Cilician Taurus Mountains. Thirty-three percent of the total species growing in Turkey are found along this diagonal, with 5% more or less restricted to it. One explanation for this present species richness is neo-endemism, with plant distribution patterns related to the Diagonal (Ekim & Güner, 1986).

Key to *Hesperis* Species with Pendulous Fruits in Turkey

1a. Fruit contorted, flattened . . . . . *H. cappadocica*
1b. Fruits not contorted, ± terete.
  2a. Fruits glabrous (rarely only sparse short simple hairs).
    3a. Petals purple, greenish to brownish purple, the limb strongly deflexed; fruits dehiscent . . . . . *H. persica*
    3b. Petals deep violet or mauve, the limb not deflexed; fruits indehiscent . . . *H. podocarpa*
  2b. Fruits glandular, with long simple or mixed hairs.
    4a. Stem patently hispid, with simple, glandular, and rarely bifurcate hairs . . *H. pendula*
    4b. Stem not hispid, with mostly glandular hairs.
      5a. Biennial; basal leaves broadly spatulate to lyrate, semifleshy; petals 13–17.5 mm long; fruits dehiscent. . . . . *H. anatolica*
      5b. Perennial; basal leaves narrowly lyrate, not fleshy; petals 17–21 mm long; fruits indehiscent. . . . . *H. hamzaoglui*

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A New Species of *Draba* (Brassicaceae) from North Anatolia, Turkey

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ABSTRACT. *Draba anatolica* A. Duran & Dinç, a new species of Brassicaceae collected from Kastamonu province in North Anatolia, Turkey, is described and illustrated. The species grows on rocky crevices and stony slopes in Ilgaz Mountain National Park. It is related to *D. siliquosa* M. Bieberstein, from which it mainly differs in its densely stellate-pubescent fruit, the 10- to 20-flowered inflorescence, the stellate-pubescent stems with five to eight leaves, the petals 4.5–5 mm long and sparsely stellate-pubescent externally, and the pubescent, 8–10 mm, fruiting pedicel. The ecology, biogeography, and conservation status of the species are discussed. Fruit and seed coat surface micromorphology of *D. anatolica* are examined by SEM, and the chromosome number and morphology are determined, with $2n = 16$.

Key words: Alysseae, Brassicaceae, *Draba*, IUCN Red List, North Anatolia, Turkey.

Draba L. is the largest genus in the Brassicaceae and includes about 300 species distributed in north temperate and arctic regions and in the mountains of Central and South America (Hedge, 1968; Hickey & King, 1997; Tan & Stevanović, 2002). Recently, eight new taxa have been described, and the number of *Draba* species in the world has been increased (Al-Shehbaz, 2002, 2004). Ecologically, most species grow in open, rocky, or gravelly places (Walters & Akeroyd, 1993). The genus was previously revised by Coode and Cullen (1965) for the *Flora of Turkey*, with 16 species. Two more *Draba* species have since been added to the Turkish flora, *D. terekemensis* Yıldırımlı and *D. narmanensis* Yıldırımlı. (Yıldırımlı, 2000). This paper describes and illustrates another new *Draba* species from Turkey.

The authors collected the type specimens from Ilgaz Mountain National Park in North Anatolia in 2006. On close examination, the authors concluded that these specimens clearly differed from related *Draba* in Turkey. Based on a study of the literature (Coode & Cullen, 1965; Hedge, 1968; Tolmachev, 1970; Yıldırımlı, 2000; Tan & Stevanović, 2002) and herbarium specimens of *D. siliquosa* M. Bieberstein, the authors conclude that the specimens represent a new species.

MATERIAL AND METHODS

Each numeric value in the species description is the average of 10 measurements from different specimens of the new species (*A. Duran 7372 & M. Dinç* and *M. Dinç 2982 & A. Duran*) from the type locality. For fruit and seed micromorphology, SEM images were taken with a JSM-5600 microscope (JEOL, Tokyo, Japan). The descriptive terminology of Brochmann (1992) has been followed. For cytogenetic study, root tips from germinated seeds were pretreated with α-mono-bromonaphthalene at 4°C for 16 hours, fixed in ethanol:acetic acid (3:1) overnight, and then stored at 4°C. Fixed root meristems were hydrolyzed in 1 N HCl for 21 minutes at room temperature, and chromosomes were stained with 2% aceto-orcein. The classification of chromosomes, the length of long and short arm, arm ratio, centromeric index, and relative chromosome length were measured by Image Analysis System (BAB Bs200ProP Image System software, BAB Mühendislik Müh, Turkey). Chromosomes were classified using the nomenclature of Levan et al. (1964).

SPECIES OF *DRABA*

Draba anatolica A. Duran & Dinç, sp. nov. TYPE: Turkey. Kastamonu: Ilgaz Mtn., Büyük Hacettepe, rock crevices, 1750 m, 10 July 2006, *A. Duran 7372 & M. Dinç* (holotype, KNYA; isotypes, GAZI, HUB). Figures 1, 2.

Haec species *Drabae siliquosae* M. Bieberstein affinis, sed ab ea planta omnino stellato-pubescente (non supra vel omnino glabra), foliis caulinis 5 ad 8 (non 0 ad 3), racemis 10- ad 20-floris (non 4- ad 8-floris), pedicellis fructiferis 8–10 mm longis stellato-pubescentibus (non 2–6 mm glabris), petalis 4.5–5 mm longis extus sparse stellato-pubescentibus (non 2–4 mm longis extus glabris), fructu dense stellato-pubescente (non glabro) atque stylo 1–1.3 mm longus (non usque ad 0.4 mm) differt.

Perennial, cushion-forming herbs, 8–16 cm tall, stellate-pubescent throughout; caudex branched, 1.5–2.5 mm diam., with sterile rosettes, covered with leaf remains of previous years; trichomes mostly stalked-stellate, 4-branched, rarely forked or simple, 0.1–0.2 mm diam.; stems erect, unbranched, pubescent. Sterile rosette leaves densely imbricate, sessile,

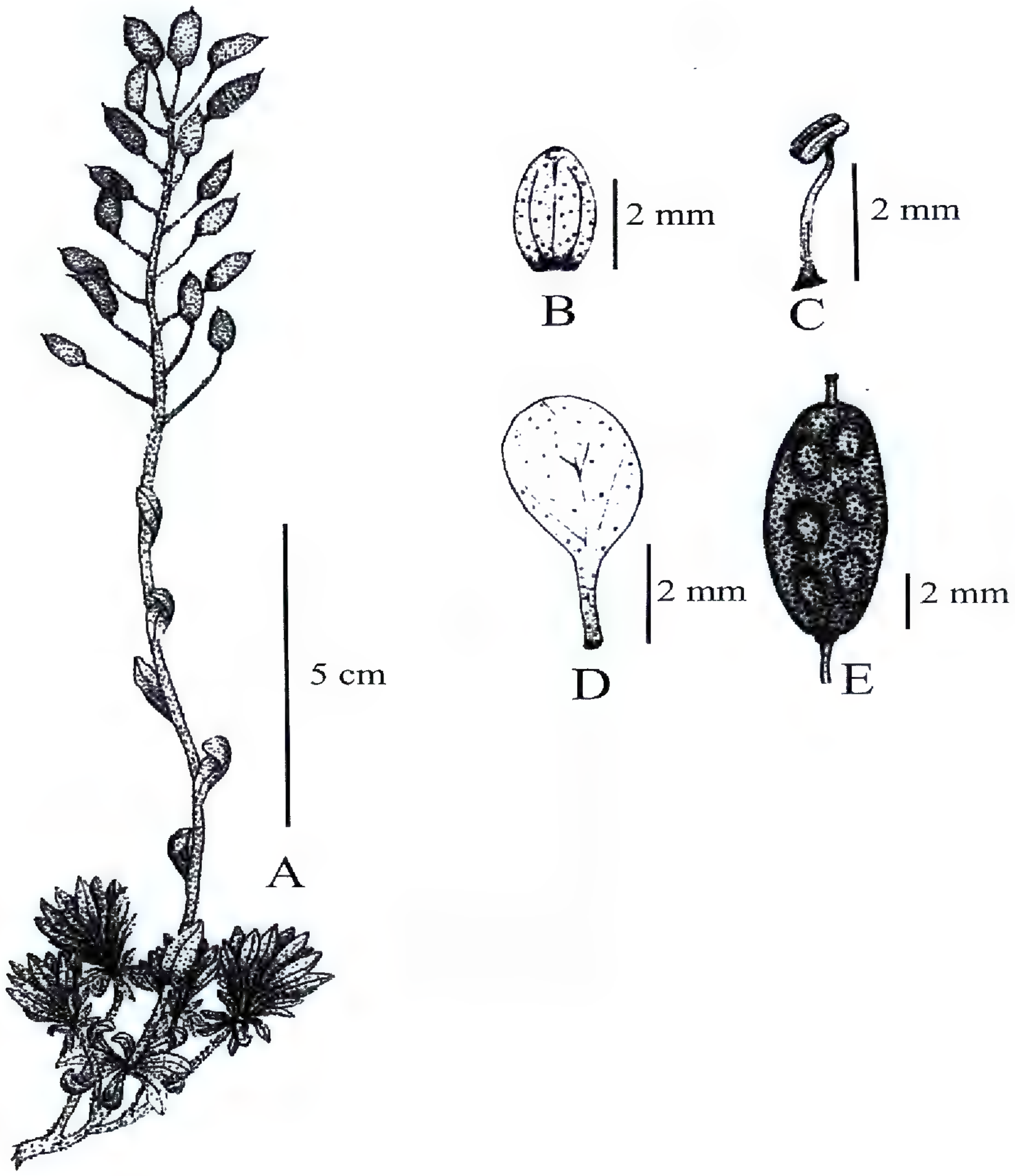

Figure 1. *Draba anatolica* A. Duran & Dinç. —A. Plant. —B. Sepal. —C. Stamen. —D. Petal. —E. Fruit. A, E drawn from the holotype *Duran 7372 & Dinç* (KNYA); B–D drawn from the isotype *Duran 7372 & Dinç* (HUB).

narrowly oblanceolate-spatulate, entire, distinctly 1-veined, 10–15 × 1–2.5 mm, stellate-pubescent and ciliate with long simple trichomes at the base; basal leaves rosulate, sessile, persistent, oblanceolate, 5–12 × 2–3 mm, pubescent with stellate trichomes and ciliate with long simple trichomes only at basal margins, base narrowly cuneate, margin entire, apex acute; cauline leaves decreasing in size toward inflorescence, 5 to 8, sessile, not similar to basal leaves, oblong to oblong-lanceolate, mostly entire or rarely minutely few-toothed, 8–14 × 1–4 mm. Racemes 10- to 20-flowered, ebracteate, elongated in fruit; fruiting pedicel equal or longer than fruit, 8–10 mm, divaricate, stellate-pubescent. Sepals ovate-oblong, pale green, 2.5–3 × 1.25–1.5 mm, erect, externally sparsely pubescent with stellate trichomes; petals white, spatulate, 4.5–5 × 2–2.5 mm, externally sparsely pubescent with stellate trichomes, apex rounded; claw 2.5–3.5 mm; stamens with filaments 2–2.5 mm, dilated at the base; anthers linear-oblong, 0.6–0.7 mm. Fruit oblong, 6–8 × 2.3–3 mm, densely stellate-pubescent, compressed parallel to septum, slightly twisted; valves pubescent with mostly 4-branched, rarely forked trichomes, base and apex subacute; persistent style 1–1.3 mm, glabrous; seeds 6 to 10, brown, ovate, biseriate.

The seed coat of *Draba anatolica* was studied by SEM. The seeds average 1.3–1.4 × 0.8–0.9 mm, with alveolate-reticulate surface ornamentation. The reticulum is rectangular or polygonal in shape, and 15–25 μm diam. The thickness of the reticulum wall is 2.5–3.2 μm, and the lumen is not warty (Fig. 2).

Chromosome number. The somatic chromosome number and morphology of *Draba anatolica* were studied and determined as $2n = 16$. Total chromosome length ranges from 1.41–2.58 μm. Chromosomal classification is given in Table 1. The total length of the haploid set is 15.90 μm. The eight chromosome pairs of the new species were found to be five metacentric and three submetacentric.

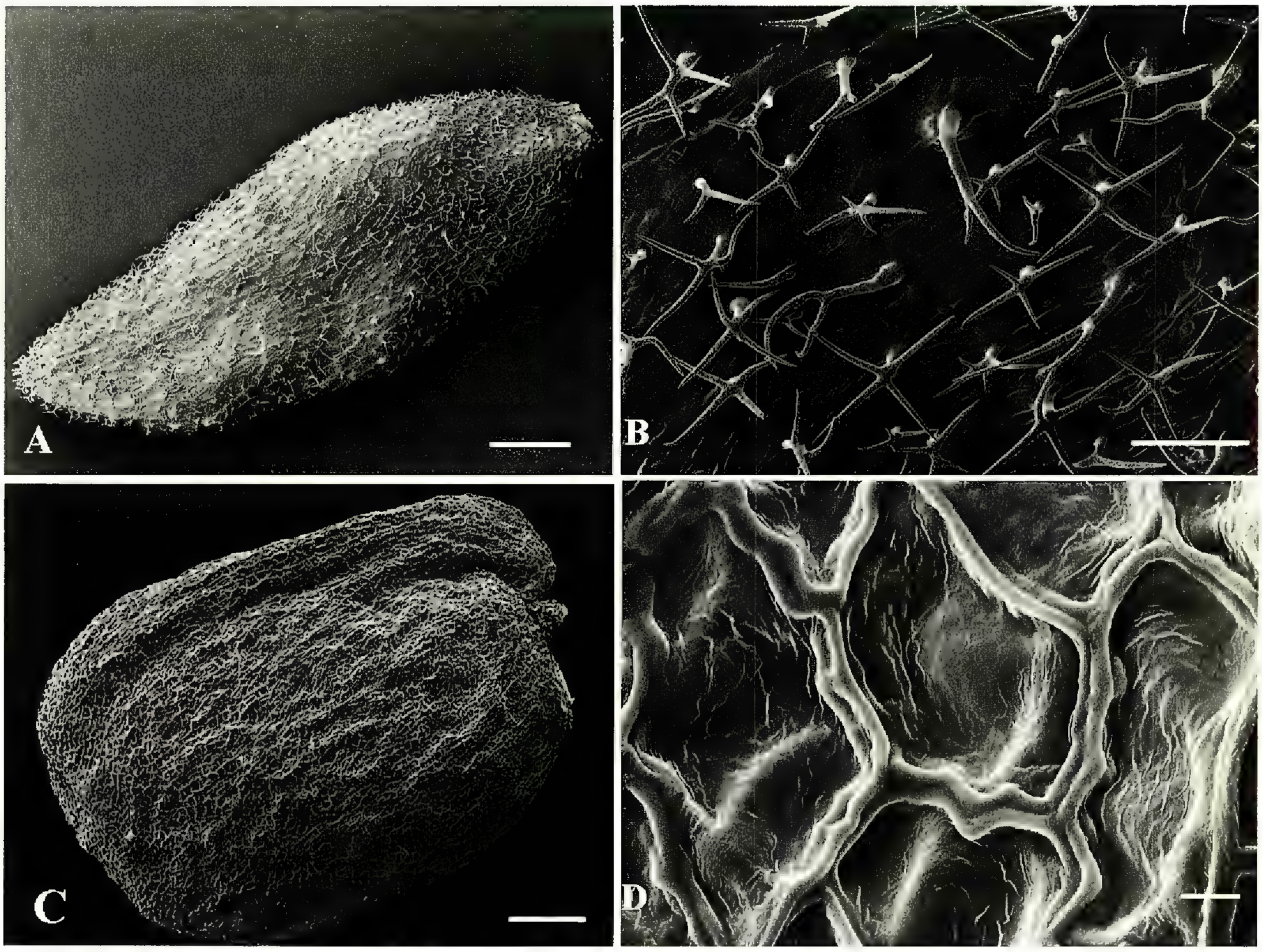

Figure 2. *Draba anatolica* A. Duran & Dinç. A, B. SEM images of fruit. —A. General view. —B. Surface details. C, D. SEM images of seeds. —C. General view. —D. Surface details. Scale bars: A = 1 mm; B, C = 200 μm; D = 5 μm.

Distribution and ecology. *Draba anatolica* is endemic to the Euro-Siberian region. It has only been collected at the type locality in Ilgaz Mountain National Park in North Anatolia. According to field investigations, one population of the new species was found, with approximately 100 mature individuals observed on rocky sites at 1750–1800 m. Associates of the new species included *Juniperus nana* Willdenow, *Genista vuralii* A. Duran & Dural, *Ranunculus illyricus* L. subsp. *illyricus*, *Asyneuma virgatum* (Labillardière) Bornmüller, *Jasione supina* Sieber, and *Aster alpinus* L.

IUCN Red List category. *Draba anatolica* appears to be known only from the present locality, and its estimated area of occupancy is less than 10 km^2 with a population of less than 100 individuals. Because of its localized distribution and small population size, the new species should be considered Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001).

Table 1. Measurements (μm) of somatic chromosomes in *Draba anatolica*, $2n = 16$.

Chromosome pair no.	Chromosome arms (μm)		Total length* (μm)	Arm ratio (L/S)	Relative length (%)	Chromosome type
	Long arm (L)	Short arm (S)				
1	1.81	0.77	2.58	2.33	16.22	submetacentric
2	1.29	1.03	2.32	1.25	14.56	metacentric
3	1.37	0.86	2.23	1.59	14.02	metacentric
4	1.29	0.77	2.06	1.66	12.95	metacentric
5	1.34	0.65	1.99	2.00	12.92	submetacentric
6	0.98	0.77	1.76	1.26	11.03	metacentric
7	0.94	0.55	1.50	1.72	9.40	submetacentric
8	0.77	0.64	1.41	1.21	8.90	metacentric

* Total length of haploid complement: 15.90 μm.

Table 2. Diagnostic characters of *Draba anatolica* A. Duran & Dinç compared with *D. siliquosa* M. Bieberstein. Measurements for *D. siliquosa* were taken from *Flora of Turkey and the East Aegean Islands* (Coode & Cullen, 1965), *Flora Iranica* (Hedge, 1968), *Flora Hellenica* (Tan & Stevanović, 2002), and *Flora of the USSR* (Tolmachev, 1970), and from *A. Güner 4932* (HUB) and *Demirkuş 3499*, *3550* (HUB).

Character	*D. anatolica*	*D. siliquosa*
Stems	8–16 cm tall, stellate-pubescent throughout	2–15 cm tall, glabrous throughout or plants stellate-pubescent below and glabrous above
Leaves	sessile, basal ones entire, cauline ones mostly entire or rarely minutely few-toothed, with stellate trichomes	petiolate, dentate or serrate, with forked and stellate trichomes
Basal leaves	oblanceolate, densely pubescent	elliptic to linear-lanceolate, glabrous or pubescent
Cauline leaves	5 to 8	0 to 3
Petals	4.5–5 mm, sparsely stellate-pubescent externally	2–4 mm, glabrous externally
Inflorescence	10- to 20-flowered	4- to 8-flowered
Fruiting pedicel	8–10 mm, stellate-pubescent	2–6 mm, glabrous
Fruit	6–8 × 2.3–3 mm, densely stellate-pubescent with persistent style 1–1.3 mm	3–10 × 1.5–2 mm, glabrous with persistent style to 0.4 mm

Phenology. *Draba anatolica* was found flowering from May to June, and fruiting from June to July.

Discussion. The genus *Draba* (Brassicaceae), in which specific differences are often slight, is well known for its notorious taxonomic complexity, particularly in arctic-alpine areas (Hedge, 1968; Tolmachev, 1970; Walters & Akeroyd, 1993). Extensive range expansion during interglacial intervals, coupled with autogamy and sibling species formation at the diploid level, as well as multiple origins of allopolyploids and interploidal gene flow, have resulted in blurred morphological and geographic relationships in the genus (Brochmann, 1992; Widmer & Baltisberger, 1999). Due to polyploidy, *Draba* species have diverse base chromosome numbers (x = 6, 7, 8, 9, 10, 12, and 15) and diploid chromosome numbers ($2n$ = 12, 16, 20, 24, 28, 30, 32, 36, 40, 42, 48, 52, 54, 56, 60, 64, 72, 76, 80, 96, 100, 112, 120, and 128) (Warwick & Al-Shehbaz, 2006). However, the basic chromosome number of the genus is mostly x = 8 (Brochmann et al., 1992). The basic chromosome number of *D. anatolica* corresponds with x = 8, and its diploid chromosome number is $2n$ = 16. Its closest relative, *D. siliquosa*, shares a similar somatic chromosome number (Tischler, 1950).

The nature and density of the indumentum are often used in the taxonomy of *Draba* (Walters & Akeroyd, 1993). The morphological separation between some *Draba* species has commonly relied on a single character, absence versus presence, respectively, of stellate hairs on a vegetative organ (Coode & Cullen, 1965; Hedge, 1968; Tolmachev, 1970; Mulligan, 1974; Rollins, 1993; Walters & Akeroyd, 1993). Molecular studies of *Draba* have indicated that even single indumentum characters that separate *Draba* species are taxonomically significant (Scheen et al., 2002). In particular, fruit indumentum has been commonly used for the classification of *Draba* species as a definitive character (Coode & Cullen, 1965; Hedge, 1968; Walters & Akeroyd, 1993; Tan & Stevanović, 2002). Although *D. siliquosa* is a variable species for vegetative characters such as plant length, sepal size, pedicel length, and leaf indumentum, it is invariable with regard to its glabrous fruits (Coode & Cullen, 1965; Hedge, 1968; Tolmachev, 1970; Walters & Akeroyd, 1993). *Draba anatolica* can be readily distinguished from *D. siliquosa* by its densely stellate-pubescent fruit.

Otherwise, *Draba anatolica* is similar to *D. siliquosa*, a species distributed in Turkey (Gümüşhane, Trabzon, Artvin, and Rize provinces), the Caucasus, Iran, and Central and Southern Europe (Coode & Cullen, 1965; Walters & Akeroyd, 1993). Both species are perennial with leafy stems, ciliate leaves, and white flowers. In addition to the fruit indumentum, *D. anatolica* is easily distinguished by having a pubescence with mostly stellate trichomes throughout the plant, 5- to 8-leaved stems, a 10- to 20-flowered inflorescence, fruiting pedicels 8–10 mm long, and petals 4.5–5 mm long and externally sparsely pubescent. In contrast, *D. siliquosa* has both forked and stellate trichomes, 0- to 3-leaved stems that are partially pubescent or glabrous, a 4- to 8-flowered inflorescence, fruiting pedicels 2–6 mm long, petals 2–4 mm long and glabrous, and fruits glabrous and elliptic to linear-lanceolate (Table 2).

Paratype. TURKEY. **Kastamonu:** Ilgaz Mtn., Büyük Hacettepe, rock crevices, 1750 m, 25 June 2007, *M. Dinç 2982 & A. Duran* (KNYA).

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New Species of *Commelina* (Commelinaceae) from East and South-central Africa

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ABSTRACT. *Commelina lukei* Faden (Commelinaceae) is newly described from southeastern Kenya, also distributed in northeastern Tanzania and Madagascar. It is distinguished from *C. kotschyi* Hasskarl by its larger, less undulate-margined leaves, larger spathes, and different distribution and ecology; from *C. imberbis* Ehrenberg ex Hasskarl and *C. mascarenica* C. B. Clarke by its capsule shape, appendaged seeds, and consistently clasping leaf bases; and from all three species by the presence of solely acicular hairs on the adaxial lamina midrib. *Commelina milne-redheadii* Faden is newly described from Zambia, also in Angola and Democratic Republic of the Congo. It differs from *C. scaposa* C. B. Clarke by the presence of leaves on the flowering shoots and larger spathes; from *C. hockii* De Wildeman by its narrower leaves and much smaller, striped spathes; from *C. welwitschii* C. B. Clarke by its tuberous roots, fewer-veined spathes, and several- to many-flowered upper cincinnus; and from all three species by its blue flowers and seeds with a dorsal ridge.

Key words: *Commelina*, Commelinaceae, hook-hairs, IUCN Red List, seed morphology, tropical East Africa.

Commelina L. is the largest genus of Commelinaceae worldwide and in Africa. The combined areas of the *Flora of Tropical East Africa* (Kenya, Uganda, and Tanzania) and *Flora Zambesiaca* (Malawi, Mozambique, Zambia, Zimbabwe, and Botswana) are especially rich in these species (Faden, 2001). In the course of writing family treatments for these floras, eight new species of *Commelina* have been described (Faden, 1994a, 2001, 2003; Faden & Alford, 2001). Two further species are described in this paper.

Adequate descriptions of new *Commelina* species should normally include floral, capsule, and seed morphology. The frequent lack of mature seeds and well-preserved flowers in specimens of *Commelina* has led to the provisional recognition but infrequent description of new African taxa by careful researchers, such as the late J. P. M. Brenan of Kew. Two such provisional species, recognized in the Kew Herbarium, have recently been described as *C. polhillii* Faden & Alford (Faden & Alford, 2001) and *C. kituloensis* Faden (Faden, 2001).

The two new species of *Commelina* described here were either completely overlooked or treated as odd specimens at Kew. *Commelina lukei* Faden was included within *C. imberbis* Ehrenberg ex Hasskarl, but new characters have been found that can be used in herbarium specimens to clearly separate these species. Specimens of *C. milne-redheadii* Faden included a collection that had been described as *C. welwitschii* C. B. Clarke var. *glabra* K. Schumann and other collections that were associated with *C. welwitschii* but not recognized as variety *glabra*. In the present study, it has been possible to recognize *C. milne-redheadii* as a distinct species because of the availability of complete material, including liquid-preserved flowers and mature capsules and seeds. Recently discovered, unnamed collections from Angola at the Natural History Museum (BM) have increased the known geographic range and morphological variation in this species.

1. **Commelina lukei** Faden, sp. nov. TYPE: Kenya. Kwale District: Kaya Kinondo, 4°23′S, 39°32′E, alt. 5 m, edge of lowland forest on coral rag, 17 Oct. 2000, *W. R. Q. Luke et al. 7080* (holotype, US3403791; isotypes, EA, K, MO not seen, US3403790). Figures 1, 2A–C, J, 3B.

Herba perennis (vel annua) usque ad 2.5 m longa; radices tenues fibrosae; surculi erecti vel ascendentes, demum trahentes vel effusi. Folia lamina sessili lineari-lanceolata usque oblongo-lanceolata vel lanceolata, 4–13 × (0.6–)1–3 cm, basi cordato-amplexicauli, pagina adaxiali costa trichomatibus acicularibus instructa. Spathae pedunculo (1.6–)2–4(–5.5) cm longo, solitariae, (1.4–)1.8–2.5 cm longae, (0.5–)0.7–1.2 cm altae, paginis pubescentibus, marginibus ad basem per 2–5 mm connatis; cincinnus superior ex spatha exsertus, flores masculinos 1 ad 3 efferens. Flores perfecti et staminati, petalis binatis plerumque azureis. Capsulae bi- vel triloculares, bivalves, 4- vel 5-seminales; semina in ambitu plus minusve subquadrangularia 3–3.6 × 1.75–2.2 mm, testa laevi, farinosa, hilo manifeste elevato, ad ambas extremitates in appendices extenso.

Perennial (or annual); roots thin, fibrous; shoots erect to ascending, becoming trailing or straggling, to

Figure 1. *Commelina lukei* Faden. —A. Habit. —B. Spathe. —C. Male flower, front view. —D. Male flower, lateral view. —E. Bisexual flower, front view. —F. Bisexual flower, lateral view. All from cultivated material of *Luke et al. 7080*. Illustration by A. R. Tangerini.

2.5 m, rooting only near the base or decumbent; internodes to 14.5 cm, glabrous. Leaves mostly distichous, sometimes spirally arranged, sheaths 1–3 cm, sparsely pubescent with colorless hook-hairs, sometimes flushed or spotted with purple, eciliate at the apex, lamina sessile, linear-lanceolate to oblong-lanceolate or lanceolate, 4–13 × (0.6–)1–3 cm, apex acute to attenuate, base cordate-amplexicaul, margins

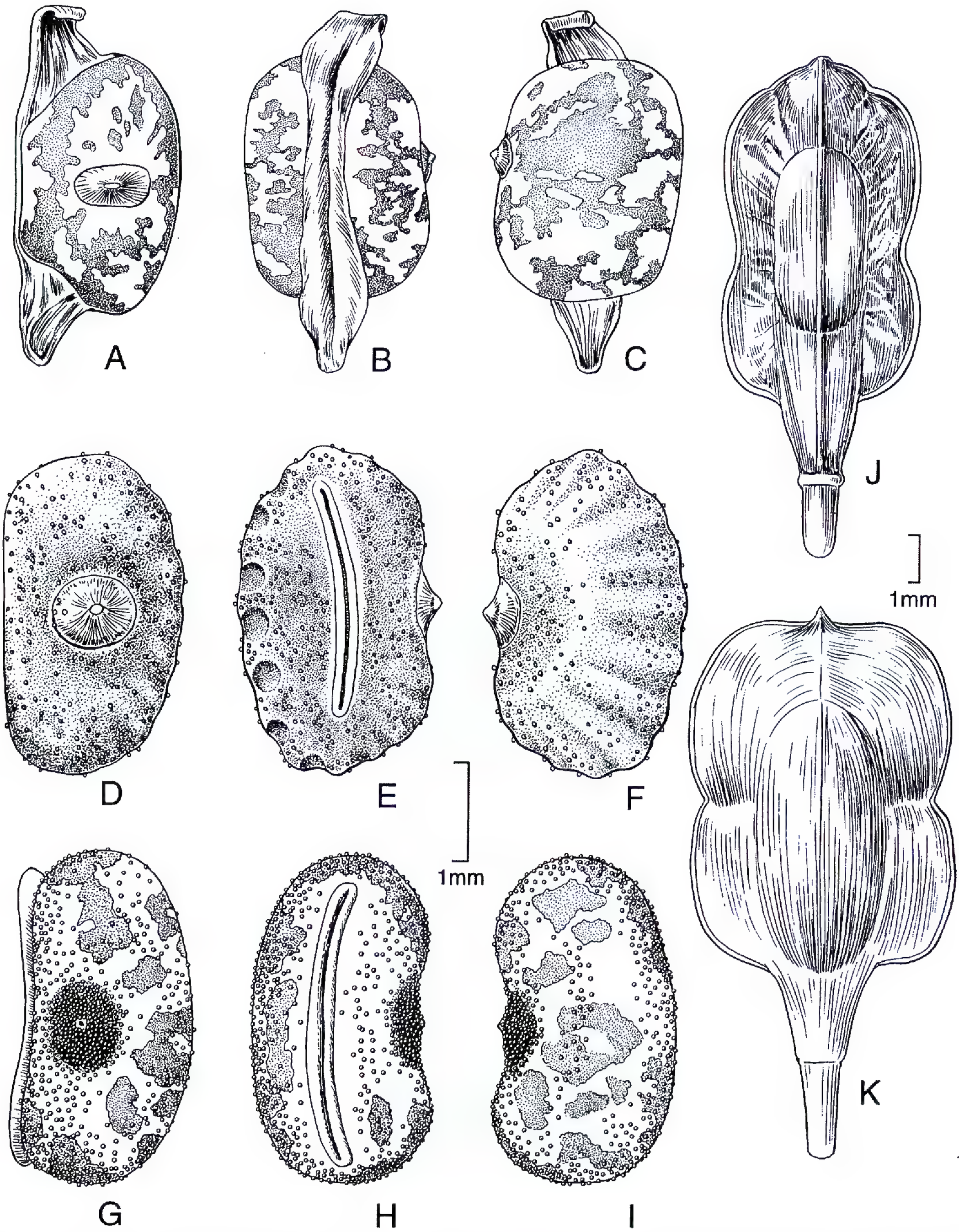

Figure 2. Capsules and seeds of *Commelina lukei* Faden, *C. imberbis* Ehrenberg ex Hasskarl, and *C. mascarenica* C. B. Clarke. A–C, J, *Commelina lukei*; D–F, K, *Commelina imberbis*; G–I, *Commelina mascarenica*. —A. *C. lukei*, ventral locule seed, lateral view. —B. *C. lukei*, ventral locule seed, ventral view. —C. *C. lukei*, ventral locule seed, dorsal view. —D. *C. imberbis*, ventral locule seed, lateral view. —E. *C. imberbis*, ventral locule seed, ventral view. —F. *C. imberbis*, ventral locule seed, dorsal view. —G. *C. mascarenica*, ventral locule seed, lateral view. —H. *C. mascarenica*, ventral locule seed, ventral view. —I. *C. mascarenica*, ventral locule seed, dorsal view. —J. *C. lukei*, capsule, dorsal view. —K. *C. imberbis*, capsule, dorsal view. A–C, J from field-collected material of *Luke et al. 7080* from Kenya; D–F, K from cultivated material of *Gillespie 4*, originally from Yemen; G–I from field-collected seeds of *Faden & Faden 77/362 bis* from Kenya (the herbarium specimens collected under *Faden & Faden 77/362* were *C. lukei*). Illustration by A. R. Tangerini.

scabrous, often slightly undulate, adaxial surface with a line of very fine, whitish, acicular hairs along the midrib, otherwise glabrous, abaxial surface sparsely pubescent with hook-hairs. Spathes solitary, peduncles (1.6–)2–4(–5.5) cm, puberulous with hook-hairs in a line or throughout, the hook-hairs of variable length; spathes (1.4–)1.8–2.5 × (0.5–)0.7–1.2 cm (folded), usually slightly to strongly falcate, sometimes just at the apex, apex acute (to acuminate), base cordate to truncate, margins shortly fused for 2–5 mm, ciliate along the fused edge, otherwise glabrous, surface pubescent with hook-hairs of 2 lengths, including some long, 3-celled hairs, green marginally, whitish with contrasting, dark green longitudinal veins toward the peduncle; upper cincinnus 1- to 3-flowered, flowers male, peduncle (1.4–)1.7–2.8 cm, long-exserted from the spathe, commonly arcuate post-anthesis, sparsely to densely puberulous with hook-hairs, sometimes of 2 sizes; lower cincinnus 5- to 7-flowered, the flowers mainly bisexual but sometimes male, peduncle 5–12 mm, glabrous or sparsely puberulous with minute hook-hairs; upper cincinnus with pedicels 4–6 mm, glabrous, lower cincinnus with pedicels 3.5–7 mm, glabrous. Flowers bisexual and sometimes male, (13–)15–21 mm wide; sepals free, hyaline green with colorless or blue-tinged margins, upper sepal lanceolate-oblong to ovate-elliptic, 2.5–4.5 × 1.2–1.5 mm, lower sepals ovate-elliptic to obovate-elliptic, 3.5–5 × 2.2–3.2 mm; paired petals (9–)12.5–16 × (6–)10–13 mm, limb broadly ovate to ovate-reniform, (5.5–)8.5–10 × (6–)10–13 mm, blue, sometimes pale blue, rarely pale rosy lilac, apex rounded to truncate or emarginate, base cordate, claw 5–6 mm, concolorous with the limb or paler, lower petal ovate to ovate-elliptic, (3.5–)4.5–7 × 2.5–5 mm, concolorous with or slightly paler than the paired petals; staminodes 3, subequal, filaments (3–)4–5 mm, blue, rarely pale rosy lilac, tipped with white or yellow, antherodes 6-lobed, 1.2–1.6 mm, yellow with tiny orange pollen sacs; lateral stamen filaments parallel basally, then divergent, then convergent distally, sometimes crossing near the apex, question mark–shaped, geniculate distal to the middle, (7.5–)11–16 mm, blue, tinged with lavender, rarely pale rosy lilac, anthers elliptic to oblong-elliptic or lanceolate-elliptic, (1.2–)1.5–2 mm, blue, violet, or blue and white, pollen white; medial stamen filament straight or arcuate-decurved, recurved at the apex, (5–)5.5–8 mm, blue, rarely pale rosy lilac, anther held near the lateral anthers, saddle-shaped, strongly curved, (2–)2.5–3.5 × 0.6–1 mm, usually blue or bluish green and yellow, with yellowish basal lobes, with 2 dark blue longitudinal lines above, pollen dull yellow; ovary oblong-ellipsoid, ca. 2 mm, 5-ovulate, style exceeding or equaling the stamens, ± sigmoid, curving laterally out of the floral midplane, strongly recurved apically, (8–)9–13 mm, entirely blue or white shading to blue distally, stigma deltate, slightly enlarged, dark blue. Capsules bi- to trilocular, bivalved, 4- to 5-seeded, oblong, (7.5–)8–9.5 × (3.6–)4–5.5 mm, constricted between the seeds, with a truncate or rounded, sometimes shortly apiculate, obdeltate apical extension, gray-green to brown, dorsal locule 1-seeded or not developed, ventral locules 2-seeded; seeds ± quadrangular in outline, ± concave at the base and apex, 3–3.6 × 1.75–2.2 mm, testa smooth, predominantly dark brown or mottled various shades of brown, white- to tan-farinose, hilum with prominent, whitish to tan papery wings that extend apically and basally into concolorous appendages, embryotega lateral, relatively inconspicuous, without a prominent apicule.

Chromosome number. There is a count of $n = 15$ from *Lewis 6062* (Lewis, 1964, as *Commelina imberbis*). I have obtained $2n = 30$ from *Taita Hills Expedition T747* (cultivated at Smithsonian Institution, cytological voucher slides: *85/106*, *85/123*, *85/124*) and from *Luke et al. 7080* (grown from seed of the type collection at the Smithsonian Institution, with voucher pressed as *R. B. Faden 2002/012*, cytological voucher slide: *05/02*) (Faden, unpublished).

Habitat. The new species has been collected from lowland evergreen forest, forest edges and clearings, open areas in montane forest, plantations, thickets, bushland, grassland, woodland, roadsides, sometimes associated with rocks in moist situations, riversides; sea level to 1000(–1700) m.

Phenology. Flowering specimens have been seen from all months.

Distribution. Southeastern Kenya, northeastern and south-central Tanzania, including Zanzibar (K7; T3, 6, 7, Z of *Flora of Tropical East Africa* [Polhill, 1988]), and Madagascar.

IUCN Red List category. *Commelina lukei* can be considered as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001). Although this species occurs in densely populated coastal areas of Kenya and Tanzania, it also occurs somewhat farther inland in more sparsely populated habitats, so it is likely not to be endangered or vulnerable. The single collection from Madagascar leaves its status there unknown.

Etymology. The new species is named in honor of William Richard Quentin Luke, whose collections, many made with Ann Robertson, have greatly increased our knowledge of the flora of tropical East Africa, especially Kenya, and whose specific collections of this species, at my request, have enabled it to

be illustrated from living material and have permitted the completion of its description.

Discussion. *Commelina lukei* is most distinctive because of its often scrambling habit, the leaf bases all amplexicaul, the adaxial leaf midrib with only acicular hairs, the stamen filaments question mark–shaped (when viewed laterally), the capsule with a rounded to truncate apical extension, and the seeds smooth with a raised hilum that is extended as appendages at both ends (Figs. 1–3). It is probably most closely related to *C. kotschyi* Hasskarl, which has similar, appendaged seeds in capsules with a similar apex. *Commelina kotschyi* differs by its distinctly annual habit, mainly smaller leaves with strongly undulate margins, the presence of only or mostly hook-hairs along the adaxial leaf midrib, smaller spathes, the absence of the upper cincinnus, and its occurrence at generally higher elevations, farther inland, and mainly or strictly in seasonally waterlogged soils.

Commelina kotschyi has largely been misinterpreted or unrecognized in the floras in which it occurs, which has compounded the problem of recognizing *C. lukei* and its affinities. For example, in the treatment of the Commelinaceae in *Flora of Southern Africa* (Obermeyer & Faden, 1985), *C. kotschyi* was treated as *C. imberbis*, but the latter does not occur in southern Africa. In both editions of *Upland Kenya Wild Flowers*, *C. kotschyi* was omitted, and the few collections of this species from the flora area were treated as *C. imberbis* (Faden, 1974, 1994b). *Commelina kotschyi* ranges from Ethiopia to South Africa and Angola and is also in India. In the only countries in which both *C. lukei* and *C. kotschyi* occur, Kenya and Tanzania, the species are allopatric, with *C. lukei* occurring mainly along the coast and extending only as far inland as the Taita Hills in Kenya and the Pare District in Tanzania and *C. kotschyi* occurring only farther inland. The two species overlap in elevation in these countries mainly because of high elevation collections of *C. lukei* from the Taita Hills (Kenya) and Western Usambara Mountains (Tanzania).

In the field and in the herbarium *Commelina lukei* has been confused mainly with *C. imberbis*, with which it is allopatric, and with *C. mascarenica* C. B. Clarke, with which it is sympatric. Both *C. imberbis* and *C. mascarenica* have more or less oblong capsules and ellipsoid seeds (Fig. 2D–I, K), and all collections with similar capsules and seeds, including specimens of *C. lukei* and *C. kotschyi*, were usually identified as "*C. imberbis*." All of these species also have leaves with bases clasping the stem (at least in the most distal leaves on the flowering shoots), solitary spathes with the margins shortly fused at the base, the hairs on the spathes relatively short, and blue flowers, so it is not surprising that the species were not well understood.

Commelina imberbis and *C. mascarenica* differ from *C. lukei* by usually having only the upper leaves amplexicaul (except in some populations of *C. imberbis*) (vs. all the leaves amplexicaul), the adaxial leaf midrib with solely or mostly hook-hairs (vs. only acicular hairs) (Fig. 3), the capsule with the apex truncate or emarginate (vs. with a rounded to truncate apical extension) (Fig. 2J, K), and the seeds not appendaged (vs. appendaged) (Fig. 2D–I). In addition, the lateral stamen filaments in both these species are less strongly curved and not question mark–shaped, as in *C. lukei*. In most populations of *C. imberbis* from Kenya and Tanzania, the spathes lack an upper cincinnus, in contrast to *C. mascarenica* and *C. lukei*. *Commelina imberbis* and *C. mascarenica* can further be distinguished from each other by their capsules and seeds, with the capsules of *C. imberbis* shorter and proportionally broader (7.3–8 × 4.5–5.8 mm vs. 8.3–10 × (3.6–)4.7–6 mm) (Fig. 2K) and the seeds dark brown, rugose, and often weakly radially ridged, with a shorter hilum (vs. dark brown or gray and mottled with lighter brown or gray, smooth, not ridged, with a longer hilum) (Fig. 2D–I).

Commelina lukei bears a striking vegetative resemblance to some plants of *C. latifolia* Hochstetter ex A. Richard, because they both have all of their leaves amplexicaul at the base and the adaxial midrib with only acicular hairs. The two species only occur close to one another in the Taita Hills, Kenya, and Western Usambara Mountains, Tanzania. In those mountains *C. lukei* is at its farthest inland extent and highest elevations. It occurs in natural habitats. In contrast, the inland species *C. latifolia* is at its nearest occurrence to the coast and it is found only in disturbed situations. It may be an introduced weed in these mountains. *Commelina latifolia* can be distinguished from *C. lukei* by lacking an upper cincinnus, its flowers having less strongly curved lateral stamen filaments, its white (vs. blue) medial petal, and its quadrate (vs. oblong) capsules with spherical, dark brown seeds that lack appendages.

The distinctive shape of the capsule apex in *Commelina lukei*, which can be recognized even when the capsule is not fully mature, is related to the shape of the seeds. The appendages of the hilum, which I expect function as elaiosomes for seed dispersal by ants, as has been observed in *C. erecta* L. (Faden, unpublished), necessitate the extension of the capsule apex from the normal, emarginate shape found in species such as *C. imberbis* and *C. mascarenica*. In specimens of *C. lukei* with less prominently appendaged seeds, the capsules have correspondingly less pronounced apical extensions and are less markedly different from those of *C. imberbis* and *C. mascarenica*.

In all three populations of *Commelina lukei* in which flowers have been photographed (*Faden, Evans & Rathbun 69/402*, *Faden & Faden 74/513*, and *Luke et al. 7080*), it has been observed that the lateral stamen filaments of the male flower in the upper cincinnus are distinctly longer than the homologous filaments of the bisexual flower in the lower cincinnus of the same spathe. Thus, it appears that stamen filament dimorphism is likely the norm in this species. This has not been noted previously in *Commelina*, although it is not uncommon is some species of *Aneilema* R. Brown (Faden, 1991, 2000).

A brief history of the discovery and final recognition of *Commelina lukei* is instructive because it shows how some species of *Commelina* that may be easy to recognize in the field can be problematic and difficult to distinguish from dried specimens. I first collected *C. lukei* in 1969 and considered it then to be distinct from *C. imberbis* because of its unusual stamen filament curvature and the presence of an upper cincinnus in the spathe. The presence of smooth seeds in some herbarium specimens from the coast seemed to further distinguish the new species from *C. imberbis*. However, until recently I could not consistently distinguish herbarium specimens of these species.

A breakthrough occurred as a result of a careful study of herbarium specimens at the Royal Botanic Gardens, Kew. During the course of this investigation, I discovered that there were, surprisingly, two similar species along the East African coast, *Commelina lukei*, with smooth, appendaged seeds (Fig. 2A–C), and a species with smooth seeds that lacked appendages and was much more like *C. imberbis*, except for the presence of a well-developed upper cincinnus (Fig. 2G–I). The latter species I had known only from southwestern Kenya, where it was called "*Commelina* sp. D" in Faden (1974, 1994b), and from Somalia, where it was treated as "*Commelina* sp. 5" in Faden (1995). A separate study of this species (Faden, 2008) demonstrated that it was *C. mascarenica*, a species from Madagascar and the Comoro Islands, but not previously recorded from mainland Africa. A brief note on *C. mascarenica* in Somalia is in Faden (2006).

The difficulty was to find characters that could distinguish all herbarium specimens of *Commelina lukei* and *C. mascarenica*, the two coastal species, which were seldom collected with capsules and seeds. Looking for any character that might be useful, I eventually noted that some specimens had only short, needle-shaped, acicular hairs along the adaxial leaf midrib, whereas other collections had mainly or exclusively, smaller hook-hairs on the midrib (Fig. 3). When I separated the specimens into two piles, based on this pubescence character, I discovered that all the specimens with only acicular hairs had all of the leaf bases clasping the stems, whereas the specimens with all or mostly hook-hairs on the midrib had only the distal leaves on the flowering shoots with clasping bases, the remaining leaves having rounded to cuneate bases. When the specimens with capsules and seeds were checked, it was found that they also separated perfectly on the basis of adaxial leaf midrib pubescence and clasping leaf bases. Thus, all specimens of these two species, regardless of the presence or absence of capsules and seeds, could be identified with certainty. The species with acicular leaf midrib hairs and consistently clasping leaf bases was *C. lukei*. The other species was *C. mascarenica*.

These two coastal species can occur together, which adds to the confusion. For example, *Faden & Faden 77/362* was not recognized as a mixed collection for many years. The dried specimens proved to be *Commelina lukei*, but the separately collected seeds and the plants subsequently grown therefrom, since renumbered *77/362 bis*, belonged to *C. mascarenica*.

The distribution of *Commelina lukei* only in mainland Africa and Madagascar is known in other Commelinaceae such as *C. mascarenica*, *Cyanotis speciosa* (L. f.) Hasskarl, and *Floscopa glomerata* (Willdenow ex Schultes f.) Hasskarl. Other species may also show this pattern, but they have not yet been fully investigated.

Paratypes. KENYA. **Kilifi:** Watamu, Plot 48, *D.O.G. 33* (EA); Mida, *R. M. Graham 1999* (EA, K); Watamu Peninsula, Mida Creek, *P. Kuchar 9967* (EA); Vipingo, 20 mi. N of Mombasa, *B. Verdcourt 1056S* [mixed collection with *Commelina mascarenica*] (K). **Kwale:** Diani, 15 mi. S of Mombasa, *A. D. Q. Agnew 9738* (EA); just before Shimoni, 4°38′S, 37°23′E, *R. B. Faden & A. J. Faden 77/362* [mixed collection with *C. mascarenica* (*77/362 bis*)] (EA, K, US); Kwale, *R. M. Graham 2038* (EA, K); < 1 km inland from Tiwi Beach, on N-S dirt rd. in area of Maweni Cottages, *P. Kuchar 7230* (EA); Nairobi–Mombasa hwy., ca. 8 km E from Mackinnon Station, *P. Kuchar 7336* (EA); Shimba Hills, Longo Magandi area, *F. Magogo & P. Glover 162* (EA); Shimba Hills, Tanga rd. near Marere Pumping Station, *F. Magogo & P. Glover 677* (EA, K); Shimba Hills, Tanga rd. near Marere Waterworks, *F. Magogo & P. Glover 904* (EA); Ras Kikadini, *S. A. Robertson 7377* (US); Maluganji Forest Reserve (including Kaya Mtae), W boundary, 4°06′S, 39°27′E, *S. A. Robertson & Q. Luke 6056* (EA); Rabai Hills, Mombaz [Mombasa], July–Sep. 1885, *W. E. Taylor s.n.* (BM); Mrima Hill, *B. Verdcourt 1851S* (BR, K). **Mombasa:** Bamburi, Coraldene Beach Hotel, *F. Ng'weno 95* (EA). **Teita:** Maungu Station to Rukanga, ca. 1 mi. S of Mombasa–Nairobi rd., 3°35′S, 38°44′E, *R. B. Faden 70/149* (EA, K); Taita Hills, Chawia Forest, Bura Bluff, 3°29′S, 38°21′E, *R. B. Faden, A. Evans & P. E. Glover in R. B. Faden 70/454* (EA, US); Taita Hills, Mbololo Hill (Mraru Ridge), rd. from Msau, stream crossing 0.5 km from Mwambirwa Forest Station (toward Msau), *R. B. Faden, A. Evans & M. Githui 71/212* (EA, US); Maungu Station–Rukanga rd., 2–3 mi. from Maungu Station, *R. B. Faden, A. Evans & G. Rathbun 69/402* (EA, K); Mt. Kasigau, lower slopes above Rukanga, *R. B. Faden, A. Evans & G. Rathbun 69/412* (EA, K); Voi–Taveta

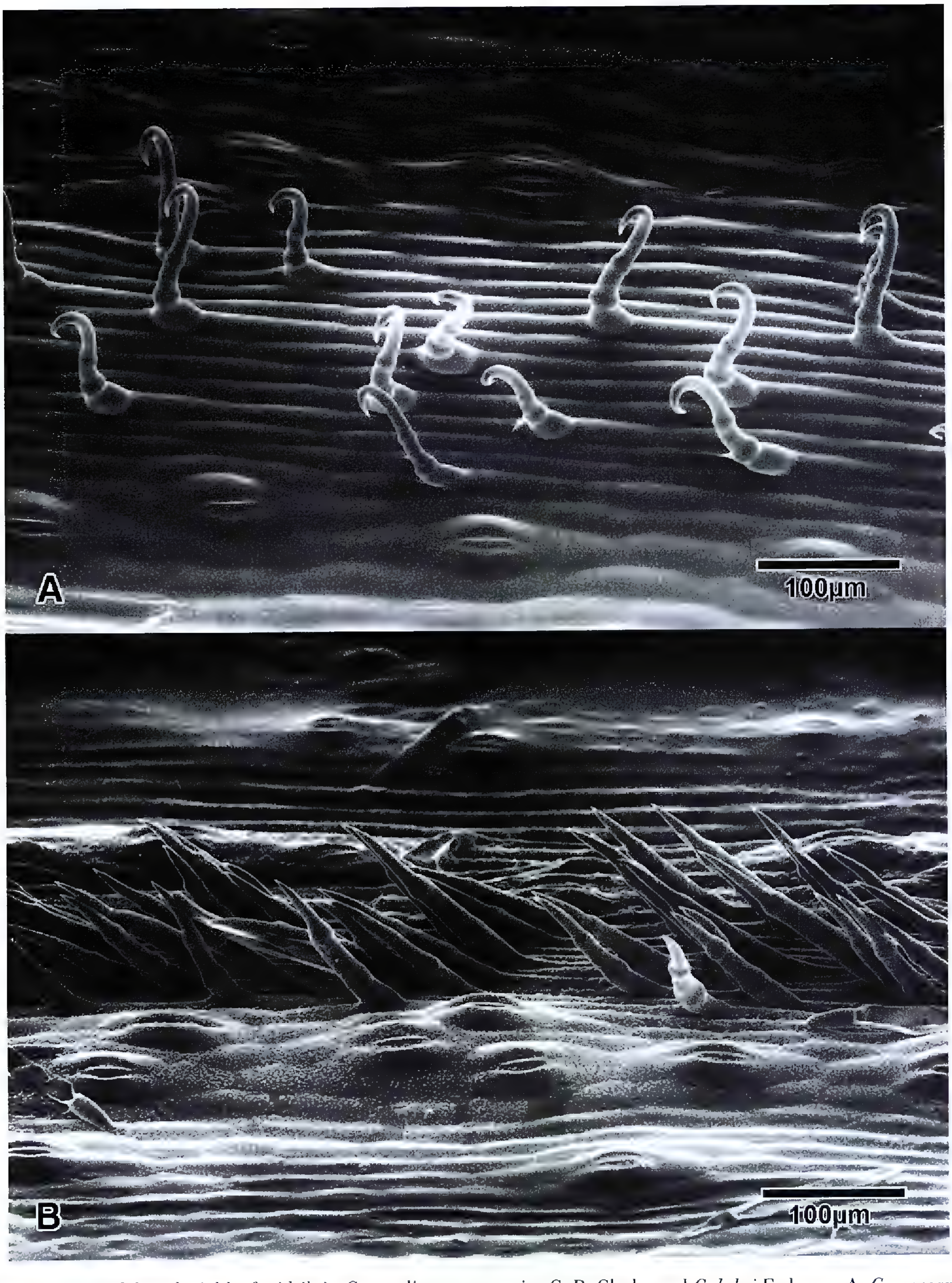

Figure 3. Hairs of the adaxial leaf midrib in *Commelina mascarenica* C. B. Clarke and *C. lukei* Faden. —A. *C. mascarenica*, showing 3-celled hook-hairs (from cultivated material grown from the seed collection of *Faden & Faden 77/362 bis*, originally from Kenya). —B. *C. lukei*, showing acicular hairs (from cultivated material of *Luke et al. 7080*, originally from Kenya). SEM images taken with Philips XL30 ESEM (Eindhoven, The Netherlands) using fresh, uncoated leaves.

rd., 28 km toward Taveta from turnoff on Nairobi–Mombasa rd., 3°30′S, 38°19′E, *R. B. Faden & A. J. Faden 74/513* (EA, K); Taita Hills, Mlashu Village, 3°20′S, 38°24′E, *G. Mwachala et al. in EW3255* (EA); Voi, *E. R. Napier* 913 (EA, K); Taita Hills, Ngangao Forest, 3°22′S, 38°20′E, *Taita Hills Expedition T747* (EA); Sagala Hill, 3°30′S, 38°36′E, *Taita Hills Expedition T1066* (EA). **District Unknown:** "British East Africa," s. loc., *C. F. Elliott 236A (336A?)* (K); "K7," *F. Ng'weno in EA15479* (EA). MADAGASCAR. **Province Uncertain:** "Boïna" (fide Perrier de la Bâthie, 1938), *W. Bojer s.n.* [specimen marked "B"] (P). TANZANIA. **Handeni:** Kideleko, *A. E. Archbold 566* (K). **Lushoto:** West Usambaras, Mkusu Valley betw. Mkuzi & Kifungilo, *R. B. Drummond & J. H. Hemsley 2198* (BR, EA, K); Amani rd. to Derema, *C. H. S. Kabuye 188* (EA); Amani, top of Bomole, *S. A. Renvoize & R. A. Abdallah 1641* (K); Amani, *R. Soleman*

7481, *7482* (EA, K); Amani, Derema, *B. Verdcourt 155* (BR, EA, K); Amani, *A. Zimmermann 87*, *8233* (EA). **Njombe:** Lupembe, upper Ruhudje [= Ruhudji] [River], *Schlieben 1057* (B). **Pangani:** Bushiri, *H. G. Faulkner in Kew 629* (BR, K). **Pare:** Kiruru, *A. E. Haarer 1443* (EA, K). **Tanga:** coast near Bomandani, 8 mi. S of Moa, near sea, *R. B. Drummond & J. H. Hemsley 3699* (BR, EA, K); Amboni, *W. Geilinger 154* (K); Kange Estate, *H. Faulkner 876* (K); Sawa, *H. Faulkner 4081A* (K); Tanga area, 6.3 mi. W of Tanga, *W. H. Lewis 6062* (K, US); 11 km from Tanga off Korogwe rd., *R. M. Osborn 102* (EA, K). **Uzaramo:** Oyster Bay, *M. Batty 70* (K). **Zanzibar:** s. loc., *W. Bojer s.n.* (K); s. loc., Oct. 1873, *J. M. Hildebrandt 1054* (BM); near Pete, ca. 6°16′S, 39°24′E, *R. J. Robins 32B* (EA); Chwaka, *J. H. Vaughan 1745* (EA, K). COUNTRY UNCERTAIN. Pemba, Zanzibar & Mombas islands, *W. Bojer s.n.* (TCD).

2. Commelina milne-redheadii Faden, sp. nov. TYPE: Zambia. Mwinilunga District: Kalenda Plain, damp ground near exposed "laterite" by Water Hole, 18 Oct. 1937, *E. Milne-Redhead 2824* (holotype, K [sheet 2 of 2]; isotypes, BM, BR, K [sheet 1 of 2]). Figure 4.

Commelina welwitschii C. B. Clarke var. *glabra* K. Schumann in Kunene-Sambesi-Exped., 183. 1903. TYPE: Angola. Nambali, 7 Oct. 1899, *H. Baum 256* (holotype, B not seen; isotypes, BM, K).

Herba perennis; radices tuberosae anguste fusiformes; surculi erecti vel ascendentes, (10–)15–48 cm longi. Folia pro parte maxima basalia vel interdum caulina, lamina lineari vel in aliquibus foliis distalibus caulinis lanceolata, (1.5–)3–16.5 cm longa, basi 3–6(–9) mm lata, in medio 1.5–3 mm lata. Spathae solitariae, (1.5–)1.6–3.1 cm longae, (0.5–)0.7–1.1 cm altae, marginibus haud connatis, ciliatis, paginis plerumque glabris, purpureofasciatis secus venas; cincinnus superior (1 vel)2 ad 10 flores efferens, pedunculo ex spatha longe-exserto. Flores caerulei, petalo inferiore ovato vel ovato-lanceolato, albo vel ut videtur pallide lilacino. Capsulae triloculares, bivalves, usque ad 5-seminales; semina valde dimorpha, semine loculi dorsalis 3.15–3.5 × ca. 1.85 mm, fere laevi, crista mediodorsali nulla, semina loculorum ventralium (2–)2.4–2.85 × 1.5–1.6 mm, crista mediodorsali valde prominenti, testa subtiliter et irregulariter reticulata.

Perennial geophytic herb; roots tuberous, tufted on a short, thick caudex, uniformly thick, then tapered distally, or narrowly fusiform, to 4 mm thick; shoots tufted or apparently solitary, erect to ascending, or decumbent basally, unbranched to sparsely branched, up to 4-noded, not rooting at the nodes, (10–)15–48 cm, bases to 10 mm thick, covered by bladeless or nearly bladeless sheaths; internodes to 25 cm, glabrous or with a line of pubescence below the node. Leaves mostly basal on short sterile shoots or predominantly cauline (in some detached shoots), basal sheaths to 3.3 cm, the distal ones 1–3.5 cm, surface glabrous, or solely with a line of uniseriate hairs along the fused edge, or sparsely pubescent all over with short uniseriate hairs, ciliate at the apex, lamina sessile, conduplicate to rolled up (longitudinally), linear (to lanceolate in some reduced distal cauline leaves), (1.5–)3–16.5 cm, 3–6(–9) mm wide at the base, 1.5–3 mm wide in the middle, base broadened into the sheath, apex acute to acuminate, margins ciliate, at least basally, not scabrid or rarely scabrid apically, surfaces glabrous, veins sometimes prominently raised abaxially. Spathes solitary, peduncles (1.5–)2.7–10(–20) cm, glabrous to densely puberulous, the pubescence sometimes including hook-hairs, spathes not at all to slightly falcate, (1.5–)1.6–3.1 × (0.5–)0.7–1.1 cm (folded), base rounded to cordate, apex acute to acuminate, margins free, glabrous or ciliate at least in basal half, surfaces usually strongly striped with purple along the veins, usually glabrous, occasionally hirsute with uniseriate hairs; upper cincinnus (1 to)2- to 10-flowered, producing male and bisexual flowers, peduncle long-exserted, 11–28 mm, glabrous to densely puberulous with hook-hairs, lower cincinnus 7- to 15-flowered, producing bisexual and male flowers, peduncle 7–10 mm, sparsely to densely puberulous with hook-hairs. Flowers bisexual and male; pedicels glabrous to sparsely puberulous with hook-hairs, 3.5–8 mm in the upper cincinnus, 2.5–6 mm in the lower cincinnus; upper sepal lanceolate-elliptic, 3–5.5 × ca. 2 mm, lateral sepals free, ovate to ovate-elliptic or obovate-elliptic, 3.5–6.5 × 2.5–3 mm, outer margins apparently hyaline lilac; paired petals ca. 7.5–8 × ca. 5.5–6 mm, blue (bright blue fide *Milne-Redhead 2824*), limb broadly ovate, ca. 4–4.5 × ca. 5.5–6 mm, claw ca. 3–4 mm, lower petal ovate to lanceolate-ovate, 3–7.5 × 2–5 mm, white (fide *Milne-Redhead 2824*) or apparently pale lilac or light blue (in dried specimens), apex acuminate, margin sometimes erose basally; staminodes 3, subequal, filaments 3–6 mm, antherodes 6-lobed, ca. 0.7–2 mm, the medial lobes (pollen sacs) relatively large, apparently entirely yellow ("orange" fide *Milne-Redhead 2824*); lateral stamen filaments ca. 6–9 mm, anthers (1.3–)1.8–2.5 mm, with blackish pollen sacs, medial stamen filament ca. 4.5–7 mm, anther saddle-shaped, the apex sometimes recurved, ca. 1.4–3 mm, lacking sterile basal lobes, apparently entirely yellow; ovary ca. 1.2–2 mm, style ca. 8–12 mm, stigma slightly enlarged. Capsules trilocular, bivalved, up to 5-seeded, oblong-ellipsoid, (2.25–)5–6.5 × (1.3–)2–3 mm, shortly apiculate, greenish tan to stramineous, dorsal capsule valve commonly deciduous, the ventral valve then strongly recurved, the deciduous valve commonly with the apex and sometimes also the base bifurcated, commonly strongly wrinkled, especially over the seed, dorsal locule 1-seeded, indehiscent, ventral locules 1- to 2-seeded, dehiscent; seeds strongly dimorphic; dorsal locule seed adherent to the capsule wall, strongly dorsiventrally compressed,

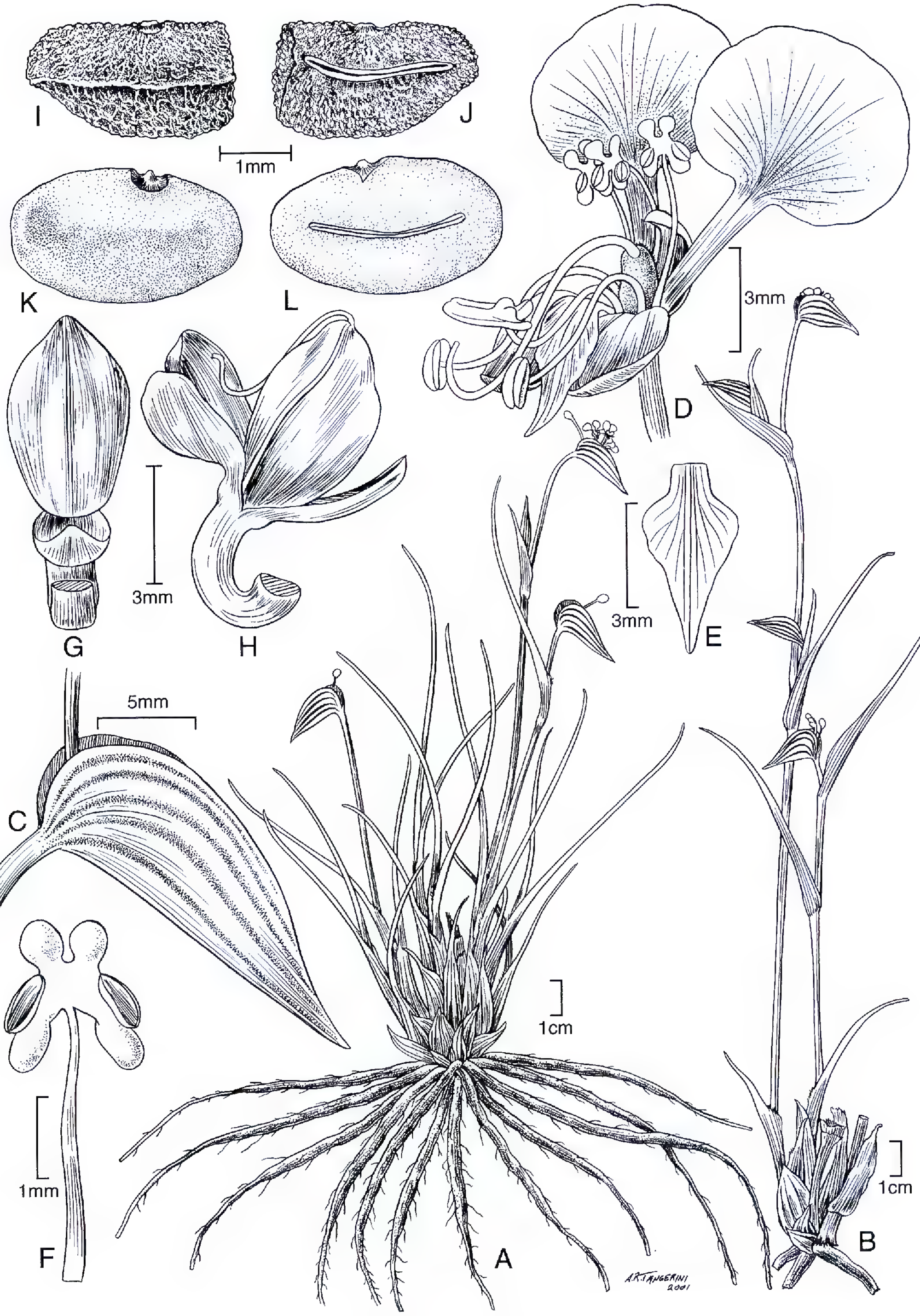

Figure 4. *Commelina milne-redheadii* Faden. —A. Habit. —B. Flowering shoot. —C. Spathe. —D. Bisexual flower, front/lateral view. —E. Lower petal. —F. Staminode. —G. Immature fruit, dorsal view. —H. Immature fruit, lateral view. —I. Ventral locule seed, dorsal view. —J. Ventral locule seed, ventral view. —K. Dorsal locule seed, dorsal view. —L. Dorsal locule seed, ventral view. All from *Milne-Redhead 2824* (K): A, C & I–L from sheet 2 of 2; B from sheet 1 of 2; D–H from *Kew Spirit Collection 38421*. Illustration by A. R. Tangerini.

ellipsoid, mounded middorsally, rounded or truncate at one end and acute or rounded at the other end (the ends dissimilar), 3.15–3.5 × ca. 1.85 mm, testa grayish pink or pale orange-brown, smooth or with a few short, shallow, irregular, dorsal furrows; ventral locule seeds strongly dorsiventrally compressed, broadly ovate to deltate, with a strongly raised middorsal ridge running the length of the seed, (2–)2.4–2.85 × 1.5–1.6 mm, testa dark brown, finely and irregularly reticulate on all surfaces, the reticulum composed of lines of slightly paler, bead-like cells in rows, not farinose; embryotega lateral, almost completely covered by beaded cells so as to obscure its demarcation from the testa, with a small, low, blunt, central projection; hilum raised and slightly sigmoid, ca. 3/4 the length of the seed.

Chromosome number. Unknown.

Habitat. The new species has been collected from moist to marshy places, apparently in grassland, sometimes associated with laterite, also in dry forest.

Phenology. Flowering September to November, and February.

Distribution. Angola to northwestern Zambia, and southern Democratic Republic of the Congo.

IUCN Red List category. Commelina milne-redheadii can be considered as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001). This species may be genuinely uncommon to rare, at least in Democratic Republic of the Congo and Zambia, from which single collections are known, but *Commelina* species tend to be undercollected, and the specimens of *C. milne-redheadii* come from a wide area. From what is recorded about the habitat of this species, there is nothing that would account for its apparent scarcity other than undercollecting.

Etymology. This species is named in honor of Edgar Wolston Bertram Handsley Milne-Redhead, not merely because he collected the type, but also because he more carefully documented Commelinaceae flowers than almost any other 20th-century botanist through his excellent collections, including spirit material of flowers, and detailed descriptive notes on the labels. Moreover, he inspired other botanists, such as Peter Taylor and Roger M. Polhill, to do the same. I have retained the hyphen in the species name because it links two words, in this case surnames that usually stand independently, according to Article 60.9 of the *International Code of Botanical Nomenclature* (McNeil et al., 2006).

Discussion. Sheet 2 of 2 at Kew of *Milne-Redhead 2824* has been selected as the holotype because it contains mature seeds in the packet on the sheet, although the young spathes on this sheet could not have been the source of the seeds.

Commelina welwitschii var. *glabra* was distinguished from the typical form of that species by its blue flowers. It clearly belongs to *C. milne-redheadii*. Even if it were desirable, the variety cannot be raised to species rank as *C. glabra* because *C. glabra* C. B. Clarke, a species from India, precludes it. Although a replacement name could have been selected, that was rejected because it would have retained the new species based on Schumann's concept of it as merely a blue-flowered plant similar to *C. welwitschii*. I consider *C. milne-redheadii* to be quite distinct morphologically from *C. welwitschii* (see below), its flower color being only one of a suite of differences.

Commelina milne-redheadii is distinctive because of its geophytic habit, short, cauline leaves, free-margined spathes, sky-blue flowers, frequent presence of hook-hairs on the pedicels (at least in the lower cincinnus), and strongly keeled ventral locule seeds (but see below). It can be confused with *C. scaposa* C. B. Clarke because of its often short cauline leaves, long-pedunculate spathes with free margins, and a multiflowered upper cincinnus. It differs most clearly by the regular presence of leaves on the flowering shoots, larger spathes, and blue flowers. The almost never collected leaves of *C. scaposa*, to the extent that they are known, are much broader than those of *C. milne-redheadii* and are apparently produced on separate shoots after the precocious, more or less leafless flowering shoots arise.

Among other geophytes with free-margined spathes, *Commelina milne-redheadii* also shows some resemblance to *C. hockii* De Wildeman and *C. welwitschii*. It differs from the former by its narrower leaves, much smaller, purple-striped spathes, blue (vs. white to pink) flowers, and smaller capsules; and from the latter by its tuberous roots (vs. a beaded rhizome), fewer-veined spathes, usually several- to many-flowered (vs. 1-flowered) upper cincinnus, blue (vs. yellow) flowers, and smaller, trilocular capsules.

Sheet 2 of *Milne-Redhead 2824* (K), the only specimen of this species with a complete base and root system, shows most of the foliage on short, apparently sterile, basal shoots (Fig. 4A). It is not certain whether these are just young flowering shoots that have yet to elongate or they are strictly vegetative shoots. Based on its small flowering shoots, in comparison with other specimens, this plant appears to have only recently started flowering, so possibly the sterile basal rosettes could have produced flowering shoots too. Sterile rosettes are present at the bases of some, but not all, shoots in other collections of this species. Although such basal shoots might character-

ize this species, as they do *Aneilema pomeridianum* Brenan and *Cyanotis longifolia* Bentham, they would not necessarily be present in specimens consisting only of detached flowering shoots. Thus, our understanding of the habit of *C. milne-redheadii* is incomplete.

The strongly dimorphic seeds seem to be very distinctive. However, the seeds of *Commelina hockii* and *C. scaposa* are incompletely known, so they, too, could possibly show such a dimorphism. The very strong middorsal keel on the ventral locule seeds has not been seen elsewhere in *Commelina*. Among the species that have been studied, only *C. scandens* Welwitsch ex C. B. Clarke has a middorsal ridge, but it is not nearly as pronounced as in *C. milne-redheadii*. The only other collection seen of *C. milne-redheadii* with nearly mature seeds, besides the type, is *Gossweiler s.n.* (BM 71280). These seeds do not show a middorsal keel, but they are not fully mature, so it remains to be demonstrated whether this feature truly characterizes the species.

An unusual feature of *Commelina milne-redheadii* is the large size of the pollen-bearing lobes on the staminodes (Fig. 4F). Although such lobes are present in most species of the genus, they typically are very tiny and are often inconspicuous. In *C. milne-redheadii* they would seem to be capable of producing a significant amount of pollen, but nothing is known about the pollen itself.

Commelina milne-redheadii is recorded mainly from moist places, e.g., in vlei and among marsh herbs. The notes on *Quarré 2717* are particularly informative. In contrasting this collection with *Quarré 2670* (*C. scaposa*), Quarré states that *2717* occurs in rather moist situations whereas *2670* usually grows in dry savanna. There is a single record of the new species from dry forest.

Paratypes. ANGOLA. **Benguela:** "Country of the Ganguellas and Ambuellas," *J. Gossweiler 2059* (K). **District unknown:** Nambali, *H. Baum 256* (BM, K); Luassenha, *J. Gossweiler 3531* (BM); Malange, Capunda, na reserva da Palance Preta Gigante, *C. Henriques 723* (K); Malange, *R. G. N. Young 781* (BM); Dala, valley of Chiumbe, *R. G. N. Young 1270* (BM); s. loc., *J. Gossweiler s.n.* (BM 71279 & BM 71280). DEMOCRATIC REPUBLIC OF THE CONGO. **Katanga:** Pastorale, Section 1, *P. Quarré 2717* (BR [3], US).

Acknowledgments. I thank Quentin Luke for collecting the species that is herein named for him, especially viable seeds; Estrela Figueiredo for help in localizing the collections from Angola; Audrey J. Faden for looking after my living research plants for very many years; and Alice Tangerini for the line drawings.

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Lectotypification of *Allium tel-avivense* (Liliaceae) Endemic to Israel

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Abstract. *Allium tel-avivense* Eig (Liliaceae), endemic to Israel, is lectotypified.

Key words: *Allium*, Israel, Liliaceae.

Allium tel-avivense Eig (Liliaceae) was published in Eig et al. (1931: 75). Eig provided the following characters (translated from the original Hebrew text) and contrasted them with the characters of *A. aschersonianum* Barbey as a part of a key to the species of *Allium* L.:

> "15. Plants short (10–25 cm) of the region of the sea shore; leaves usually undulate and prostrate. [perennial herb] light soils. Shefela, Sharon [Plain], Acco Plain. January–April...*A. tel-avivense* Eig
>
> —Plants 30–50 cm high of the Negev and Jordan Valley; leaves much shorter than stem; filaments white. Negev, Lower Jordan Valley. March–May...*A. aschersoniánum* Barb."

Allium tel-avivense was demoted to the rank of subspecies under *A. aschersonianum* Barbey by Oppenheimer (Oppenheimer & Evenari, 1940: 189). Oppenheimer contended that the name *A. tel-avivense* was not described adequately by Eig et al. (1931) and the characters that distinguish this new subspecies of *A. aschersonianum* were not published in Latin; thus, it remained a nomen nudum. Oppenheimer provided a reference to the basionym, a detailed description in Latin, and a line drawing, and cited a single specimen ([AAR] 985).

Feinbrun (1948) recognized *Allium tel-avivense* as a distinct species on the basis of a comparative caryological and morphological study of *A. tel-avivense*, *A. aschersonianum*, and *A. dumetorum* Feinbrun & Szelubsky (Szelubsky, 1950). She reduced *A. aschersonianum* subsp. *tel-avivense* (Eig) Oppenheimer to synonymy of *A. tel-avivense*, provided a diagnosis in Latin and a detailed description in English, and established the name taxonomically by comparing the main characters that distinguish *A. tel-avivense* from *A. aschersonianum*. She reiterated Oppenheimer's assertion that the name *A. tel-avivense* remained a nomen nudum until her publication. Later, she clarified that the name "is valid" according to the *International Code of Botanical Nomenclature* (Feinbrun-Dothan, 1986: 97). However, she did not cite any article to support that clarification.

Indeed, the name *Allium tel-avivense* was validly published by Eig (Eig et al., 1931) since the requirements of Articles 32–45 of the ICBN (McNeill et al., 2006) have been satisfied for valid publication prior to 1935. In particular, since the name was published prior to 1 January 1935, there was no requirement for a Latin description (ICBN Art. 36, McNeill et al., 2006). Consequently, Oppenheimer's assertion was not correct. In addition, Eig did clearly provide in his key a number of differentiating characters. However, Eig did not cite a type or refer to type material and accordingly, there is no holotype. Also, there is no evidence on AAR 985 or in the literature that Eig could have seen that specimen. Feinbrun (1948: 148) cited 11 specimens deposited in HUJ as "Specimens seen." Feinbrun did annotate each of those 11 specimens (plus two additional ones at HUJ) as syntype. Nonetheless, those specimens cannot stand as syntypes (ICBN Art. 9.4, McNeill et al., 2006) since Eig referred to localities and did not cite specimens.

Any specimen for which there is evidence that Eig had studied prior to 1931 would be considered as original material. There is no evidence that AAR 985 was one of the specimens used by Eig in preparing his key, and thus it is not eligible as the lectotype (J. McNeill, 2006, pers. comm.). Of the 11 specimens cited by Feinbrun (1948) (i.e., the lectotype and in Specimens examined, both below), Eig was the sole collector of three and co-collector of four additional specimens. Eig was also the sole collector of two and co-collector of three additional specimens, which were not cited by Feinbrun and are deposited in HUJ. Among the specimens collected by Eig only, HUJ 25824 (Fig. 1) bears his original handwritten label. Thus, this specimen best qualifies for original material that can be selected as a lectotype. It is also a very good specimen comprising all plant organs. The official HUJ specimen label further bears the annotation "*Allium tel avivense* Eig" in Feinbrun's handwriting.

Allium tel-avivense Eig, Pl. Palestine Anal. Key: 75. 1931. *Allium aschersonianum* Barbey subsp. *tel-avivense* (Eig) Oppenheimer, in Oppenheimer & Evenari, Bull. Soc. Bot. Genève, 2^{me} sér., 31: 189, Fig. VII. 1940. TYPE: [Israel.] Philistean

Figure 1. Lectotype of *Allium tel-avivense* Eig (*A. Eig s.n.*, HUJ 25824).

Plain, Tel Aviv, near Nordiya, 9 Mar. 1924, *A. Eig s.n.* (lectotype, designated here, HUJ 25824).

Habitat and distribution. *Allium tel-avivense* ($2n = 16$) (Szelubsky, 1950; Feinbrun, 1950) is endemic to the coastal plain in Israel and grows on sandy loam and calcareous sandstone hills (Feinbrun-Dothan, 1986: 97; Danin, 2004: 400). The abundance of *A. tel-avivense* was categorized by Fragman et al. (1999: 12) as rare. Danin (2008) reports that nowadays, many

individuals of *A. tel-avivense* still exist in uncultivated lands that remained undisturbed and whose soil fits its preferences. He predicts that as a result of the progress of urbanization and agricultural cultivation of the coastal plain it may be under threat of extinction.

Specimens examined. [*EZF, A. Eig, M. Zohary & N. Feinbrun*; *EFZ, A. Eig, N. Feinbrun & M. Zohary*. Underlined HUJ numbers denote the specimens cited by Feinbrun, 1948]. ISRAEL. **Acco Plain:** Jidro, 25 Mar. 1927, *E. Smoly s.n.* (HUJ 25821, 25827). **Philistean Plain:** Environs de Jaffa, Apr. 1900, *R. Yoffé-Rogoff s.n.* (AAR 985); Petah-Tiqva, 10 Mar. 1922, *A. Eig s.n.* (HUJ 25826); Nahalat Yehuda, 20 Mar. 1922, *A. Eig s.n.* (HUJ 25823); hills on the way to Petah-Tiqva, 10 Apr. 1922, *A. Eig s.n.* (HUJ 7426); Petah-Tiqva, 10 Apr. 1922, *A. Eig s.n.* (HUJ 25819); Schehunat Borochov, 11 Mar. 1925, *A. Eig s.n.* (HUJ 7442); environs of Wadi Rubin, 25 Feb. 1926, *EZF s.n.* (HUJ 25822); environs of Bene Beraq, 18 Mar. 1926, *EFZ s.n.* (HUJ 7430); Bash-shit, 3 Apr. 1927, *EFZ s.n.* (HUJ 25825); Schehunat Borochov, 15 Mar. 1927, *EZF s.n.* (HUJ 7449); environs of Sarafand, 21 Mar. 1932, *A. Eig & M. Zohary s.n.* (HUJ 7450); environs of Tel Aviv, Nahalat Izhak, 7 Apr. 1936, *EZF s.n.* (HUJ 25829, HUJ 7443). **Sharon Plain:** Herzliya, 4 Mar. 1927, *E. Smoly s.n.* (HUJ 25830); Caesarea, 28 Mar. 1927, *E. Smoly s.n.* (HUJ 25828); environs of Pardes Hanna, 28 May 1932, *A. Eig & M. Zohary s.n.* (HUJ 25820); Zarkaniye, near Binyamina, 13 July 1937, *EZF s.n.* (HUJ 7429).

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Neotypification of *Rumex aeroplaniformis* (Polygonaceae) Endemic to Israel

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ABSTRACT. *Rumex aeroplaniformis* Eig (Polygonaceae) is shown to be a validly published and legitimate name and is neotypified. *Rumex rothschildianus* Aaronsohn ex Evenari is reduced to synonymy of *R. aeroplaniformis* and is lectotypified.

Key words: Israel, Polygonaceae, *Rumex*.

Rumex aeroplaniformis Eig (Polygonaceae) was published in Eig et al. (1931: 99) in Hebrew. Eig provided the following characters (translated from the original Hebrew text) as a part of a key to the species of *Rumex* L.:

> "4 (1). Lower part of fruit tepals tubular and enveloping the pedicel; upper part 3-lobed with two side lobes broad and one middle lobe narrow and shorter than the side lobes; fruit aeroplane-like; stem erect, unbranched with ± dense terminal inflorescence; leaves (except lower) entire and sessile. [annual] Light soils. Sea shore area. March–April...*R. aeroplanifórmis* Eig"

Eig (1931: 111) also published the name *Rumex aeroplaniformis* as an entry in a table entitled "1) Espèces méditerraneo-orientales (E. Med.)." On the basis of this publication only, it would seem to be a nomen nudum, as indicated by Hill et al. (1938: 243). In addition, Eig (1932: 27) listed this name in the second part of his 1931 publication.

The same species was published under the name "*Rumex rothschildianus* Aaronsohn apud Evenari" in Oppenheimer and Evenari (1940: 212) as part of a critical revision of the plants, which were collected in Cisjordan, Syria, and Lebanon and partially determined by Aaron Aaronsohn (1876–1919). Although *R. rothschildianus* was discovered by Aaronsohn as early as 1906, it was only published 21 years after his tragic death. This publication included a detailed description in Latin, two line drawings, and citations of five specimens, plus an outline of the history of the discovery of the species, Aaronsohn's consultations with experts in Europe, and the process of the selection of the name. No reference was made to *R. aeroplaniformis*.

Of those five specimens, AAR 1654 bears the original specimen label handwritten by Aaronsohn and carries three notes handwritten by Evenari in German on AAR letterheads. The first note includes a remark stating that there is no doubt that the plant is identical to the species Eig listed in his analytical key as *Rumex aeroplaniformis* Eig. Hence, Evenari was aware of Eig's name and delimitation of the species.

Eig et al. (1948: 17) (published by Zohary & Feinbrun using Eig's [1895–1938] literary estate) listed "*Rumex rothschildianus* Aarons. (*R. aeroplaniformis* Eig)" in the key to the species of *Rumex*, and thereby established the usage of the former name. Subsequently, Rechinger (1949: 32), in his preliminary work toward a monograph of *Rumex* in Asia, listed "*R. aeroplaniformis* Eig *in lit.*" as a synonym under "*Rumex rothschildianus* Aaronsohn ap. Evenari."

Subsequent authors ignored the name *Rumex aeroplaniformis* Eig, and persistently used the name *R. rothschildianus* Aaronsohn ex Evenari. Those included: Zohary (1966, 1976/1989), Dafni and Heyn (1978), Polak (1984a, b), Feinbrun-Dothan and Danin (1991/1998), Heller and Heyn (1994), Fragman et al. (1999), Rottenberg (2001), Rottenberg and Parker (2003), and Danin (2004).

Rumex aeroplaniformis is validly published in Eig et al. (1931: 99) and is legitimate. The requirements of Arts. 32–45 of the *International Code of Botanical Nomenclature* (McNeil et al., 2006) have been satisfied. In particular, since the name was published prior to 1 January 1935, there was no requirement for a Latin description (ICBN Art. 36, McNeill et al., 2006). In addition, Eig (Eig et al., 1931) provided in his key a number of differentiating characters. Consequently, *R. aeroplaniformis* has priority over *R. rothschildianus*.

Rumex aeroplaniformis was published without a citation of a type or reference to any type material. In addition, no specimens of this species that were collected or annotated by Eig exist in HUJ. Furthermore, there is no evidence that Eig studied any of the five specimens collected by Aaronsohn and cited by Evenari (Oppenheimer & Evenari, 1940: 213), which are deposited in AAR (now in HUJ).

In the apparent absence of any of Eig's original material (ICBN Art. 9 Note 2, McNeill et al., 2006), a neotype may be selected (Art. 9.11).

Three specimens belonging to the first collection of *Rumex rothschildianus* by Aaronsohn in 1906 and

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Figure 1. Neotype of *Rumex aeroplaniformis* Eig (*A. Aaronsohn 766*, AAR ex MPU 29668).

numbered with his original collection number (766) are deposited in AAR: AAR 1680 bearing mostly vegetative parts, ex MPU 29667 bearing a female plant, and ex MPU 29668 bearing a male plant and a female plant. The ex MPU specimens were sent in 1906 by Aaronsohn to [G., sic] Jules Alexandre Daveau in Montpellier, who in turn had them mounted and sent to Dr. G. Beauverd, Curator of the Herbier Boissier in Geneva, for determination (Evenari in Oppenheimer & Evenari, 1940). Beauverd's hand-written reply, dated 12 July 1906 and stating that the plant is novel, is attached to ex MPU 29667. *Aaronsohn 766* (ex MPU 29668) (Fig. 1) is the only specimen bearing both male and female plants, which are exemplary. Therefore, it is designated here as the neotype of *R. aeroplaniformis*.

Rumex aeroplaniformis Eig, Pl. Palestine Anal. Key: 99. 1931. TYPE: [Israel.] Sharon Plain: Zarkaniye, 9 Apr. 1906, *A. Aaronsohn 766*

(neotype, designated here, AAR ex MPU 29668). Figure 1.

Rumex rothschildianus Aaronsohn ex Evenari, Bull. Soc. Bot. Genève, 2me sér., 31: 212. 1940. Syn. nov. *Acetosa rothschildiana* (Aaronsohn) Á. Löve & B. M. Kapoor, Taxon 16: 520. 1967. TYPE: [Israel.] [Sharon Plain:] "Loco classico," 3 Apr. 1916, *A. Aaronsohn s.n.* (lectotype, designated here, AAR 1654).

Discussion. Following the reply of Dr. Beauverd, Daveau suggested to Aaronsohn to name the species *Rumex orchidioides*. AAR 1654 bears the original specimen label handwritten by Aaronsohn with "*Rumex orchidioides*" on this label, and AAR 1680 bears the same annotation on the AAR label.

Eventually, Aaronsohn did not accept that suggestion, and preferred the specific epithet "*rothschildianus*" to honor Baron Edmond de Rothschild, his benefactor (Evenari in Oppenheimer & Evenari, 1940).

Evenari did not designate a holotype in the protologue. According to Art. 9.10 (McNeill et al., 2006), in lectotype designation a syntype must be chosen if such exists. The five specimens cited by Evenari constitute the syntypes of *Rumex rothschildianus* ([Israel.] [Mount Carmel:] Zikhron Ya'aqov, 17 Mar. 1912, *A. Aaronsohn s.n.* [AAR 1676]; Zikhron Ya'aqov, 14 Apr. 1912, *A. Aaronsohn s.n.* [AAR 1678]. [Sharon Plain:] Zarkaniye, 9 Apr. 1906, *A. Aaronsohn 766* [AAR 1680, ex MPU 29667]; Bourj, 1 Apr. 1911, *A. Aaronsohn s.n.* [AAR 1684]; "Loco classico," 3 Apr. 1916, *A. Aaronsohn s.n.* [AAR 1654]). Of those five specimens, AAR 1654 (on which seven female plants are mounted) bears Aaronsohn's handwritten annotation "loc. cl." (loco classico) on the original specimen label. It was annotated by Evenari with the new name plus "nova species!" on the AAR specimen label. Thus, AAR 1654 appears as Evenari's intended type of *R. rothschildianus*, and is therefore designated here as a lectotype.

Habitat and distribution. *Rumex aeroplaniformis* is a small, dioecious, annual, rare endemic species growing on light sandy loam soils and calcareous sandstone in the coastal plain of Israel (Zohary, 1966; Polak, 1984a). It is currently confined to the Sharon Plain, and is on the verge of global extinction as its total gene pool consists of only two surviving populations (Dafni & Heyn, 1978; Rottenberg, 2001; Rottenberg & Parker, 2003).

Etymology. The Hebrew name *Hūm'at HaAviron* (translated as "the aeroplane Rumex"), which was coined and published by Eig (Eig et al., 1931), has been commonly used since. It was approved as the Hebrew name for *Rumex rothschildianus* by The Academy of the Hebrew Language (Committee, 2000: 11). The reinstatement of Eig's scientific name would also restore the accord between the scientific name and the Hebrew name, as originally intended by Eig.

Specimens examined. ISRAEL. **Philistean Plain:** Bene-Beraq, 2 Apr. 1927, *N. Naftolsky s.n.* (HUJ); Bene-Beraq, Apr. 1928, *N. Naftolsky s.n.* (HUJ); Bene-Beraq, 21 Apr. 1930, *N. Naftolsky s.n.* (HUJ). **Sharon Plain:** environs of Natanya, 1 Apr. 1947, *M. Zohary s.n.* (HUJ); Udim, 29 Mar. 1951, *N. Feinbrun & N. Haran s.n.* (HUJ); N de Binyamina, 5 Apr. 1953, *H. R. Oppenheimer s.n.* (AAR); Wadi Falik, 22 Mar. 1956, *C. Ginsburg s.n.* (HUJ); Binyamina, Warburg neighborhood, 4 Apr. 1973, *M. Evenari s.n.* (AAR); Binyamina, 25 Mar. 1976, *R. Berliner s.n.* (HUJ); near Caesarea, Spring 1977, *M. Samsonov s.n.* (HUJ); S of Shefayim, 27 Apr. 1977, *A. Ben-Yizhak s.n.* (HUJ).

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Rubiacearum Americanarum Magna Hama Pars XXI. A New Species of *Palicourea* (Psychotrieae) from Costa Rica

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ABSTRACT. A new species of *Palicourea* Aublet (Rubiaceae, Psychotrieae) is described and illustrated: *P. palustris* A. C. Gilman & C. M. Taylor from montane Costa Rica. This species differs from *P. salicifolia* Standley by its large stipules that have well-developed lobes and are persistent with age, and by its larger corollas with relatively longer lobes.

Key words: Costa Rica, IUCN Red List, *Palicourea*, Psychotrieae, Rubiaceae.

As circumscribed by Taylor (1997), *Palicourea* Aublet (Psychotrieae) is distinguished within the Rubiaceae by its persistent stipules that are interpetiolar to usually united around the stems into a continuous sheath, and usually bilobed in their interpetiolar portions; generally brightly colored inflorescences—blue, purple, red, orange, or yellow—with the flowers usually pedicellate; corollas that are usually similarly brightly colored, five-lobed, and with well-developed tubes that are somewhat swollen at the base and glabrous internally except for a dense ring of pubescence just above this basal swelling; and drupaceous fruits with usually two pyrenes. This Neotropical genus includes about 200 species of shrubs and small trees found from sea level to montane forests (Taylor, 1997), with about 31 species in Costa Rica (Taylor, 1989). The species are typically distylous and generally pollinated by hummingbirds, and the fruits are apparently dispersed by birds (Taylor, 1997).

Palicourea palustris A. C. Gilman & C. M. Taylor, sp. nov. TYPE: Costa Rica. Heredia: Parque Nac. Braulio Carrillo, Atlantic slope of V. Barva, from Finca Gourdian (1700 m) walk 4 hr. to tent refugia at 1740 m then ca. 1.5 hr. hike S on main transect trail, 10°11′29″N, 84°06′12″W, 1860 m, 31 Mar. 2005, *A. C. Gilman 420* (holotype, INB; isotype, MO 04796838). Figure 1.

Haec species a *Palicourea salicifolia* Standley stipulis majoribus in vetustate persistentibus, foliis longioribus nervis secundariis multioribus munitis atque corollae longioris lobulis proportione longioribus ac fauce latiore differt.

Shrub or small tree, flowering at 1.5 m, to 5 m tall; stems glabrous. *Leaves* paired; blades elliptic-oblong to narrowly elliptic or oblanceolate, 5.5–15 × 1.5–3.5 cm, at apex acute to usually acuminate with tips 1–1.5 cm, at base acute to usually attenuate, drying papyraceous, glabrous on both surfaces; secondary veins 18 to 24 pairs, looping weakly to interconnect near margins, with 1 developed and 2 weak intersecondary veins usually present between pairs of secondary veins, adaxially costa prominent, secondary and intersecondary veins prominulous and remaining venation plane and invisible, abaxially costa prominent, secondary and intersecondary veins prominulous and tertiary venation visible but plane; *petioles* 7–32 mm, glabrous; *stipules* laminar, glabrous, membranaceous becoming brown and indurated with age, persistent after leaves fall, ligulate to ovate, (5)6–8(10) mm, bilobed, lobes ligulate to lanceolate-oblong, 4–5 × 2–3(4) mm, acute on some sterile branchlets to usually obtuse to rounded, sinus truncate. *Inflorescences* terminal and in uppermost leaf axils (alternatively, sessile and trichotomous), rounded-corymbiform to broadly pyramidal, ca. 5 × 6 cm (not including corollas); peduncles 2.5–3 cm; secondary axes 1 or 2 pairs; bracts narrowly triangular, acute, those subtending secondary axes 3–5 mm, those subtending pedicels 2–3 mm; pedicels 1–4 mm; peduncle, axes, bracts, and pedicels green. *Flowers* pedicellate in cymules of 3 to 5; hypanthium cylindrical, ca. 1 mm, glabrous; calyx limbs glabrous, 1.2–1.5 mm, green, membranaceous, lobed to base, lobes 5, ligulate to ovate, obtuse; *corolla* funnelform, white except yellow in throat and inside tube, strongly bent (to 90°) and gibbous at base, bent again (to 90°) just above basal swelling, curved in tube, externally glabrous, internally glabrous except with a sparsely

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Figure 1. *Palicourea palustris* A. C. Gilman & C. M. Taylor. —A. Corolla of living plant. —B. Flowering branch of living plant. —C. Flowering branch of dried specimen. A and B are photos of *Gilman 420* at the type locality in the Parque Nacional Braulio Carrillo, Costa Rica; C is from the type specimen *Gilman 420* (INB).

hirtellous ring ca. 1 mm wide just above basal swelling, with tube 7–8 × 3–5 mm wide across throat, lobes 5, ligulate to triangular, 4–5 mm, acute with a deflexed apical filamentous appendage 0.5–1 mm; *anthers* included, situated in tube, ca. 3.5 mm; stigmas 2, ca. 0.3 mm, exserted. *Infructescences* similar to inflorescences, green; fruit ellipsoid, ca. 5 × 5 mm, laterally somewhat flattened, glabrous, blue-

black; pyrenes 2, hemispherical, dorsally smooth to broadly rounded.

Distribution, habitat, and phenology. Locally common in extremely swampy sites on peaty soil, wet montane primary forest, Atlantic (i.e., Caribbean) slope of Volcán Barva in central Costa Rica, 1600–2000 m. Collected in flower in March, in fruit in January to March and June.

IUCN Red List category. We recommend the listing of this species as Least Concern (LC) according to IUCN Red List criteria (IUCN, 2001). There is at present no evidence of population decline or threat to this species, which is currently located within a nationally protected area. The wet and boggy substrate, believed to be a key habitat factor for this species, is found from 1600–2000 m across the full extent of the Parque Nacional Braulio Carrillo. From this we calculate the potential number of mature individuals in the protected area to exceed 1000, based on estimates of mature individuals per square kilometer calculated from the first author's survey data. We believe the population to be a single continuous population within these elevations in the Parque Nacional Braulio Carrillo, but lack data to assess population status and decline, beyond the observation of several hundred immature individuals across the elevational range.

Discussion. This species is similar to *Palicourea salicifolia*, also of montane Costa Rica, but these differ in both vegetative and reproductive characters as well as habitat. The leaves of *P. salicifolia* are shorter (4–8.5 cm), with only 9 to 13 pairs of secondary veins and usually shorter petioles (3–9 mm), versus 5.5–15 cm, 18 to 24 pairs, and 7–32 mm long, respectively, in *P. palustris*. The stipules of *P. salicifolia* are 2–4 mm long with triangular to linear lobes and are usually deciduous with the leaves, whereas this new species has notably larger stipules (5–10 mm long), with lobes that are more rounded in shape and usually persist longer than the leaves, often becoming indurate. These hardened, enlarged, persisting stipules are unique among Central American species of *Palicourea*. Also, *P. salicifolia* has white corollas often flushed with blue with longer tubes (6–13 mm) but shorter lobes (2–3 mm), versus white and yellow corollas with tubes 7–8 mm and lobes 4–5 mm in *P. palustris*. These two species are also known from different habitats. *Palicourea salicifolia* is found on relatively dry sites in montane forests usually dominated by *Quercus* L., whereas *P. palustris* is apparently restricted to extremely swampy sites in very wet montane forests that are not dominated by *Quercus*. The specific epithet refers to its wet habitat.

The first author initially collected sterile specimens of this species in her ecological transects (with some difficulty, because of the unstable muddy substrates on which it grows), and when the specimens could not be identified she and her field assistant, Felix Corrales, returned several times to search for fertile specimens. The plants apparently flower annually, synchronously, and for a relatively brief period.

The stipules of smaller, nonreproductive plants are sometimes markedly smaller than those of flowering branches, to as short as 5 mm with the lobes acute. Similar variation is found in other species of *Palicourea* (pers. obs., both authors), but is generally not reported because species descriptions are based on flowering or fruiting branches. The common practice of collecting sterile specimens for ecological study has expanded our knowledge of some species, and these sterile measurements are included in the above species description in parentheses. However, comparable information is not available for most *Palicourea* species.

The first author takes great pleasure in dedicating this new species to her grandfather, Peter Medwell (1913–2004), who significantly encouraged and supported her interest and work in ecology and botany.

Paratypes. COSTA RICA. **Heredia:** Parque Nac. Braulio Carrillo, Atlantic slope of V. Barva, along transect trail betw. 10°10′55″N, 84°06′18″W and 10°13′37″N, 84°05′39″W, *B. Boyle & Hibbs 972* (MO), *A. C. Gilman 6, 22, 38, 144, 156, 168, 404, 405, 430, 433, 434* (all INB, MO, and CR).

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A New Species of *Hampeella* (Musci, Ptychomniaceae) from Queensland, Australia

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Abstract. *Hampeella concavifolia* Hattaway & D. H. Norris (Ptychomniaceae) is described and illustrated from Queensland, Australia. It differs from *H. pallens* (Sande Lacoste) M. Fleischer in its teretely foliate, attenuate secondary stems; the closely imbricate, strongly concave, symmetrical leaves that have bright orange to red-brown basal cells with incrassate-porose walls; longer capsules (to 2.4 mm); and longer setae (to 14 mm). *Hampeella concavifolia* is distinguished from *H. alaris* (Dixon & Sainsbury) Sainsbury by its less differentiated alar cells, usually longer secondary stems (to 3 cm), and differences in peristome ornamentation. This new species is designated as Data Deficient (DD) according to IUCN Red List criteria.

Key words: Australia, *Hampeella*, IUCN Red List, Musci, Ptychomniaceae, Queensland, tropical rainforest.

The Ptychomniaceae are a small family of mosses nearly restricted to the Southern Hemisphere. Hattaway (1984) monographed the family and reduced the number of taxa in the seven-genus family from 29 to 19 (including species, varieties, and formae). He did not, however, validly publish the new taxon, which is the subject of this publication. Four of the seven genera in the family are monotypic: *Cladomniopsis* M. Fleischer, *Cladomnion* Hooker f. & Wilson, *Tetraphidopsis* Brotherus & Dixon, and *Dichelodontium* Hooker f. & Wilson ex Brotherus. The remaining three genera are: *Ptychomnium* (Hooker f. & Wilson) Mitten (five species), *Glyphothecium* Hampe (three species), and *Hampeella* Müller Halle (four species). This family consists of pleurocarpous mosses having stems that mostly lack a central strand and leaves that have incrassate-porose cells, short, double costae, and weakly differentiated alar cells. There is a demonstrable trend toward the obsolescence of primary stems, which is associated with the assumption of an epiphytic habit. Sporophytically, the family is defined by strongly 8-ribbed capsules with most species also having a long acicullariform rostrum on the operculum. Among the genera included in this family, *Hampeella* is distinctive in having erect secondary branches and attenuate leafy stems with reduced distal leaves. While conducting fieldwork in the tropical areas of northern Queensland, Australia, the junior author made collections of *Hampeella* that were distinctive from the other species of the genus. After further study, the authors concluded the collections represent a new species, which is described below.

Hampeella concavifolia Hattaway & D. H. Norris, sp. nov. TYPE: Australia. Queensland: Mt. Haig, 17°–18°S, 145°–146°E, 10 May 1975, *D. H. Norris 41471* (holotype, UC). Figure 1.

Haec species a *Hampeela pallente* (Sande Lacoste) M. Fleischer caulibus secundariis distaliter attenuatis teretifoliatis, foliis arcte imbricatis plus minusve symmetricis plerumque valde concavis ad insertionem aurantiacis vel ferrugineis cellulis basalibus incrassatis porosisque instructa, capsulis setisque longioribus atque exostomatum trabeculis ventralibus papillis minutis numerosis instructis distinguitur.

Plants golden-green; secondary stems to 2–3 cm high from a prostrate, very short to obsolete, heavily rhizoidal primary stem; erect stems unbranched to sparingly and irregularly branched, inconspicuously arcuate, tufted, distally attenuate; stems cross section elliptical, to 450 µm wide, with orange-brown outer stereome to 5 layers of pachydermous cells grading to leptodermous interior cells almost without a trace of a central strand. Gemmae axillary, dark brown to black, mostly on distal portions of secondary stems, filiform and uniseriate with 15 to 25 thin-walled, quadrate to rectangular cells. Rhizoids to 25 µm wide at insertion, smooth, monopodial with closely pinnate branches of reduced diameters, and with ultimate tips of the rhizoids pale, fragile, and presumably gemmiparous in function. Leaves larger on median stems, but steadily reduced toward attenuate tips, ovate-lanceolate to broadly lanceolate, closely imbricate, mostly symmetrical and concave-cucullate, sometimes complanate above, not 2-ranked, 1.9–2.5 ×

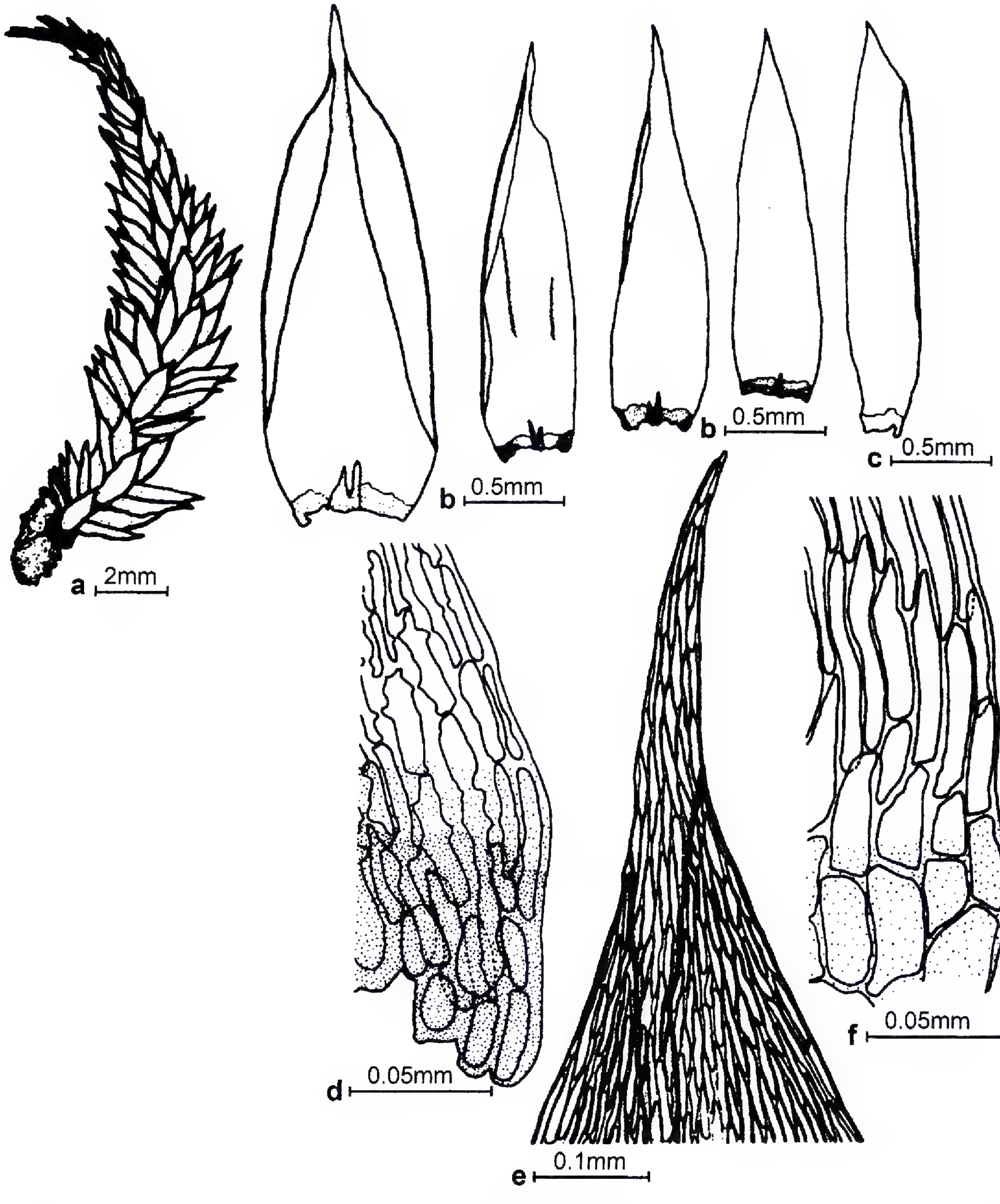

Figure 1. *Hampeella concavifolia* Hattaway & D. H. Norris. —a. Habit. —b. Four medial and proximal leaves showing transition from concave to complanate type. —c. Single distal leaf. —d. Alar region of concave leaf. —e. Apex of medial leaf. —f. Alar region of complanate (nonconcave) leaf. (a, b, and d are drawn from *D. H. Norris 44024*; c from *D. H. Norris 41842*; e from *D. H. Norris 43270*; and f from *D. H. Norris 41865*. All paratypes are deposited at UC.)

0.6–0.8 mm, ca. 3:1; medial and proximal leaves more concave and proportionately broader than distal leaves of erect tapered stems; distal leaves more lanceolate with acute to acuminate to even caudate tips, slightly concave and somewhat complanate, 0.5 mm long, ca. 4–5:1; leaf margins entire throughout or distally serrulate, recurved on one or both sides, not decurrent; median leaf cells 6–8 μm wide, 16:1, linear-fusiform, not or lightly porose, thickened at cell ends but otherwise thin-walled; alar cells and cells of basal region distinctly bright orange to red-brown with the cells strongly porose and incrassate, lumina ca. 1:1; alar region with elongate cells to 6:1, strongly demarcated from more distal cells by a single row of isodiametric cells; leaf costae short and mostly double with the largest fork on the largest leaves less than 0.2 mm long, smooth throughout;

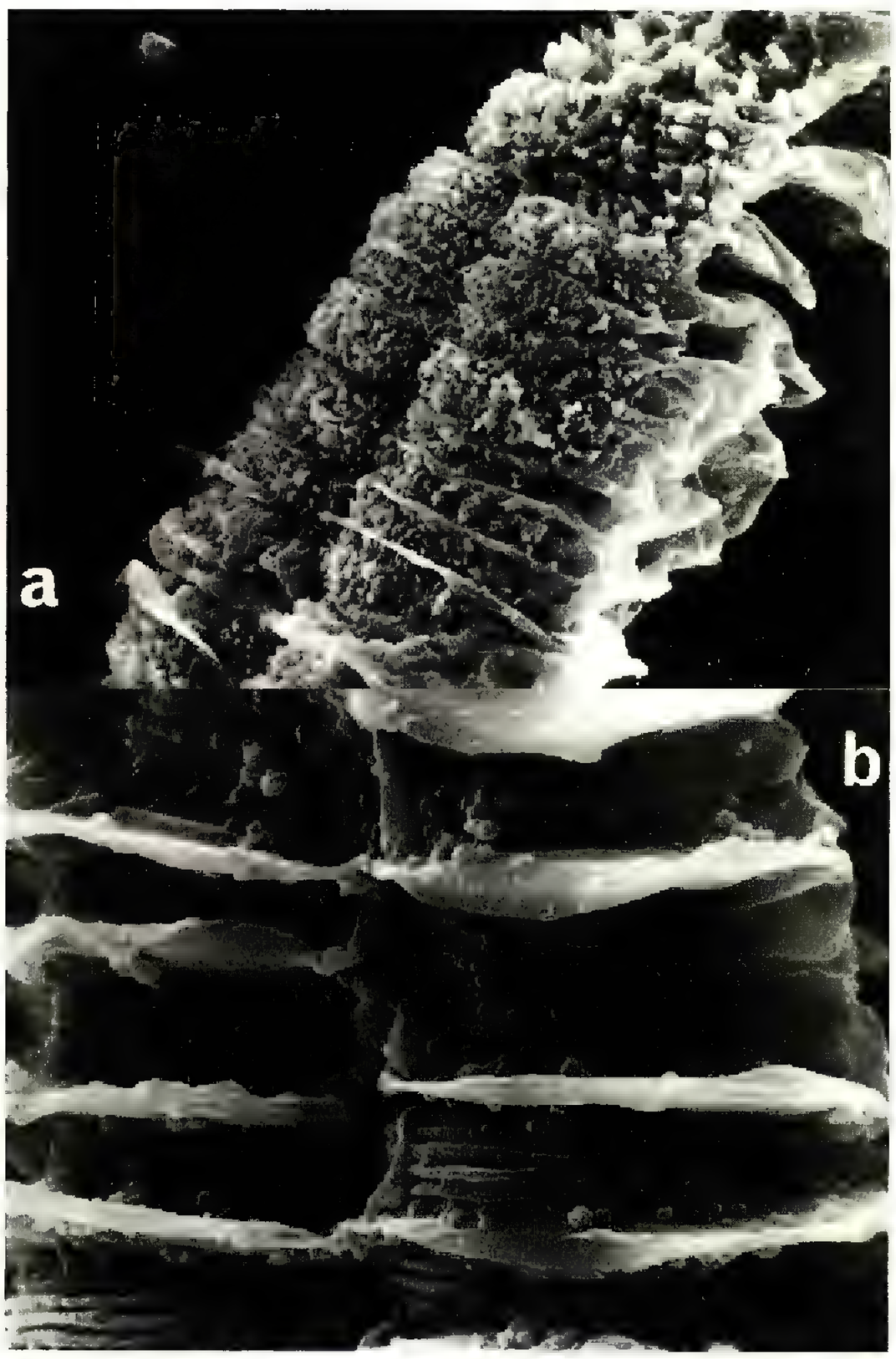

Figure 2. —a. *Hampeella alaris* (Dixon & Sainsbury) Sainsbury. Proximal and medial dorsal exostome showing papillae-covered striolations (secondary banding) (1250×). —b. *Hampeella concavifolia* Hattaway & D. H. Norris. Proximal dorsal exostome showing relative lack of papillosity on striolations (secondary banding) (1480×). (a from *D. H. Norris 29695* [UC], b from the holotype, *D. H. Norris 41471* [UC].)

axillary hairs hyaline and thin-walled, of uniform diameter throughout, ca. 150 × 10 μm with 3 cells of increasing length from base to apex. Plants dioecious; perigonia bud-like and axillary; perichaetia abundant throughout the length of the erect stems; pre-fertilization perichaetial leaves to 1 mm, ecostate and lanceolate with narrowly acute to somewhat attenuate apices; post-fertilization perichaetia seemingly without paraphyses, bracts to 4 mm, erect throughout and closely enveloping the setae. Setae 9–14 mm, smooth and straight, but distally arcuate; capsules 1.8–2.4 mm, urns 6:1, straight and strongly sulcate; opercula inclined rostrate, to 1/4 of urn length; annuli fragmenting on capsule dehiscence, thin-walled and often shed with opercula; suboral exothecial cells similar to median exothecial cells but smaller and more pachydermous; median exothecial cells isodiametric-hexagonal throughout, to 35 μm broad, with rather thick cell walls, collenchymatous; stomata phaneroporous, restricted to the short neck; exostomes to 400 μm, yellow-brown, with a zigzag median commisural line or with an inconspicuous median groove with dorsal faces cross-striate, with dorsal and ventral trabeculae high and with prominent lateral processes; ventral trabeculae with minutely papillose surfaces; endostome as long as the exostome, processes weakly keeled, not perforate, smooth to minutely verruculose; calyptrae cucullate but only tardily breaking along the side, enveloping more than 1/2 of capsule, smooth, not plicate. Spores ellipsoidal and irregular but not bimodal in diameter, with the larger and apparently viable spores 18–20 μm diam., many with tetrad scars; some spores in most capsules with precocious germination, sometimes with young gametophytes emergent from mouths of capsules.

Distribution, habitat, and IUCN Red List category. *Hampeella concavifolia* is endemic to the rainforests of northern Queensland, Australia. It is corticolous on trees and logs in montane elfin rainforests at 700–1500 m altitudes. This new species is designated as Data Deficient (DD) according to IUCN Red List criteria (IUCN, 2001).

Discussion. *Hampeella concavifolia* differs gametophytically from *H. pallens* (Sande Lacoste) M. Fleischer in its teretely foliate, attenuate secondary stems; closely imbricate, more or less symmetrical, usually strongly concave leaves; and bright orange to red-brown basal leaf cells with incrassate-porose walls. The capsules and setae of *H. concavifolia* are generally longer than those of *H. pallens* (1.8–2.4 vs. 1.4–2.2 mm and 9–14 vs. 5–10.2 mm). In addition, under SEM the ventral trabeculae of the exostome have minutely papillose surfaces compared to those of *H. pallens*, in which the only papillosity is in the form of depositions between the successive trabeculae. Although the two species are sympatric in northern Queensland, *H. concavifolia* is confined to elevations between 700 and 1500 m, whereas *H. pallens* seldom occurs above 1000 m in this part of its range.

Hampeella concavifolia is distinguished from its other close relative, *H. alaris* (Dixon & Sainsbury) Sainsbury, in having alar cells that are less strongly demarcated from the internal basal cells. In addition, the colored alar cells in *H. alaris* are isodiametric in shape to even wider than long, which is not so in those of *H. concavifolia*, and this gives the alar region in *H. concavifolia* a less strongly demarcated aspect when compared to *H. alaris*. Furthermore, the secondary stems of *H. concavifolia* are slightly longer, to 3 cm, compared to the typical 2.5 cm for those of *H. alaris*. Comparing the peristome of *H. alaris* with that of *H. concavifolia*, the newly described species lacks papillae on the striations of the dorsal surface of the exostome (Fig. 2). Vegetatively, the two taxa have symmetrical,

similarly concave leaves. However, as indicated by Figure 1, the leaves of *H. concavifolia* vary in amount of concavity, with the alar cells of the less concave examples having less strongly incrassate-porose walls. *Hampeella alaris* does not occur north of Tasmania.

The fourth species of the genus, *Hampeella leptodictyon* Brotherus, is not likely to be confused with *H. concavifolia* or the other members of the genus, as it has well-developed primary stems and is the only member of the genus to occur north of the equator. It is known only from the Philippines.

Paratypes. AUSTRALIA. **Queensland:** ca. 8 mi. from Rumula, 145°–146°E, 17°–18°S, *D. H. Norris 41658* (MO); ca. 22 mi. from Rumula, *D. H. Norris 41712*, *41842*, *41854*, *41865* (all UC); SE of Malanda, *D. H. Norris 41399* (MO, UC); Mt. Bartle Frere, *D. H. Norris 42890* (UC), *43009* (MO, UC), *43014* (MO, UC); Mt. Bellenden Ker, *D. H. Norris 42035*, *42256* (both UC); Mt. Father Clancy, *D. H. Norris 43270* (MO, UC); Mt. Haig, *D. H. Norris 41470* (UC); Thornton Peak, *D. H. Norris 43913*, *44024* (both UC).

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Validation of *Berberis chunanensis* (Berberidaceae), the Name of a Species Endemic to Zhejiang, Eastern China

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Abstract. *Berberis chunanensis* T. S. Ying (Berberidaceae) was not validly published in 1999 because no type was designated. The name *Berberis chunanensis* T. S. Ying is validly established here.

Key words: Berberidaceae, *Berberis*, China, IUCN Red List, Zhejiang.

While sorting data for the endemic species from Zhejiang, eastern China, the authors found that the name *Berberis chunanensis* described by Ying (1999: 315) as a new species is contrary to Article 37.6 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006). Because Ying did not use the word "typus," holotype, or any abbreviation or its equivalent in a modern language (e.g., the Chinese 模式) to indicate the type element, he did not validly publish the name *B. chunanensis*.

The name *Berberis chunanensis*, ascribed to T. S. Ying, is validly published here by reference to Ying's (1999: 315) validating Latin diagnosis and description and by designation of the cited specimen at PE as the holotype. The correct authorship is, therefore, *Berberis chunanensis* T. S. Ying (McNeill et al., 2006, Art. 46.2).

Berberis chunanensis T. S. Ying, sp. nov. TYPE: China. Zhejiang: Chunan Xian, Wangfu, Pushuwan, 29 Aug. 1958, *anonymous 30227* (holotype, PE; isotype, HHBG).

Distribution and IUCN Red List category. *Berberis* L., with ca. 500 species, is widespread in the Northern Hemisphere, with 215 species, including 186 endemic, distributed in China. About 140 *Berberis* species represent the genus in southwestern China (Sichuan, Yunnan, and the Tibet Autonomous Region), but a few species are also endemic to eastern China (Ying, 2001); *B. chunanensis* is an endemic species found in Zhejiang, in eastern China. According to IUCN Red List criteria (IUCN, 2001), it should be considered Vulnerable (VU), and in need of conservation.

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Ceradenia itatiaiensis, a New Species of Polypodiaceae from Southeastern Brazil

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Abstract. Recent collections of Polypodiaceae in Brazil reveal a new species of *Ceradenia* L. E. Bishop, *C. itatiaiensis* Labiak & Condack, that appears to be a narrow endemic to the Itatiaia National Park. It resembles *C. albidula* (Baker) L. E. Bishop, but differs mainly by having setae on the laminar margins. Descriptions and illustrations are provided, as well as comments on the most closely related species.

Key words: Brazil, *Ceradenia*, grammitid ferns, Itatiaia, IUCN Red List, Polypodiaceae.

Ceradenia L. E. Bishop is primarily a Neotropical genus of Polypodiaceae, with about 60 species occurring on mountains of Central and South America, and with eight species also present in Africa, Madagascar, and/or the Azores (Bishop, 1988; Parris, 2002, 2005). Parris (2002) made combinations for six species of *Ceradenia* in Africa, and there are at least two others known: *C. jungermannioides* (Klotzsch) L. E. Bishop and *C. pruinosa* (Maxon) L. E. Bishop, both species also occurring in the Neotropics. The genus is monophyletic according to the phylogenies presented by Ranker et al. (2004) and is defined mainly by the glandular paraphyses in the sori and by the absence of hydathodes.

A taxonomic treatment for six Brazilian species, with descriptions, illustrations, geographic distribution, and specimens examined, was presented by Labiak and Prado (2003). Previously, seven species were recorded from Brazil (Labiak, 2003), most occurring in the Atlantic rainforest of southeastern and southern regions.

During a study carried out by JPSC in Itatiaia, we found a new species, which we describe here.

Ceradenia itatiaiensis Labiak & Condack, sp. nov. TYPE: Brazil. Minas Gerais: Bocaina de Minas, Parque Nacional do Itatiaia, Alto dos Brejos, 1900 m, 31 Oct. 2004, *J. P. S. Condack 308 & E. Cortines* (holotype, RB). Figure 1.

Haec species *Ceradeniae albidulae* (Baker) L. E. Bishop affinis, sed ab ea laminae foliaris segmentis setis marginalibus instructis distinguenda.

Rhizomes erect, radially symmetrical, scaly, the scales 0.3–0.4 cm, golden brown, narrowly triangular, with short glands on the margin and scale surfaces. Fronds 7–14 × 1–2 cm, clustered, erect to slightly arching (fronds straight or curved); stipes 7–15 × ca. 0.4 mm, dark brown, terete, densely hirsute with castaneous setae, 1–1.5 mm, and white glandular hairs, ca. 0.1 mm, with 2 (rarely 3) enlarged globose apical cells; laminae pinnatisect, linear-lanceolate, membranaceous, abruptly tapered to the base with 1 or 2 proximal segments half the length of the middle ones, laminae gradually reduced at the apices; rachises visible in the proximal 1/3 of the lamina on both sides, castaneous, not visible on both sides of the laminae from the middle to the distal 1/3, gradually covered by greenish laminar tissue, lacking setae; segments 6–9 × 2.5–3.5 mm, deltate to linear-deltate, slightly oblique to the rachises, asymmetrical at the base, the margins slightly revolute, costae and veins obscure on both surfaces; indument of setae borne only on the laminar margins and glandular hairs on rachises, veins, and laminar tissue abaxially, setae similar to those on stipes; sinuses narrower than the segment width; veins simple or only the acroscopic basal ones furcate, ending near the laminar margin, 3 to 5 pairs per segment. Sori round, at vein apices, in 2 to 4 pairs per segment, disposed on the distal portion, not protruding beyond the lamina margins when mature, with glandular paraphyses, these with enlarged globose apical cells and shorter than the sporangia.

Distribution, ecology, and IUCN Red List category. Ceradenia itatiaiensis is epiphytic, occurring at about 1900 m, known only from the mountains of Itatiaia. According to IUCN Red List criteria (IUCN, 2001), this species can be considered as Vulnerable (VU) because

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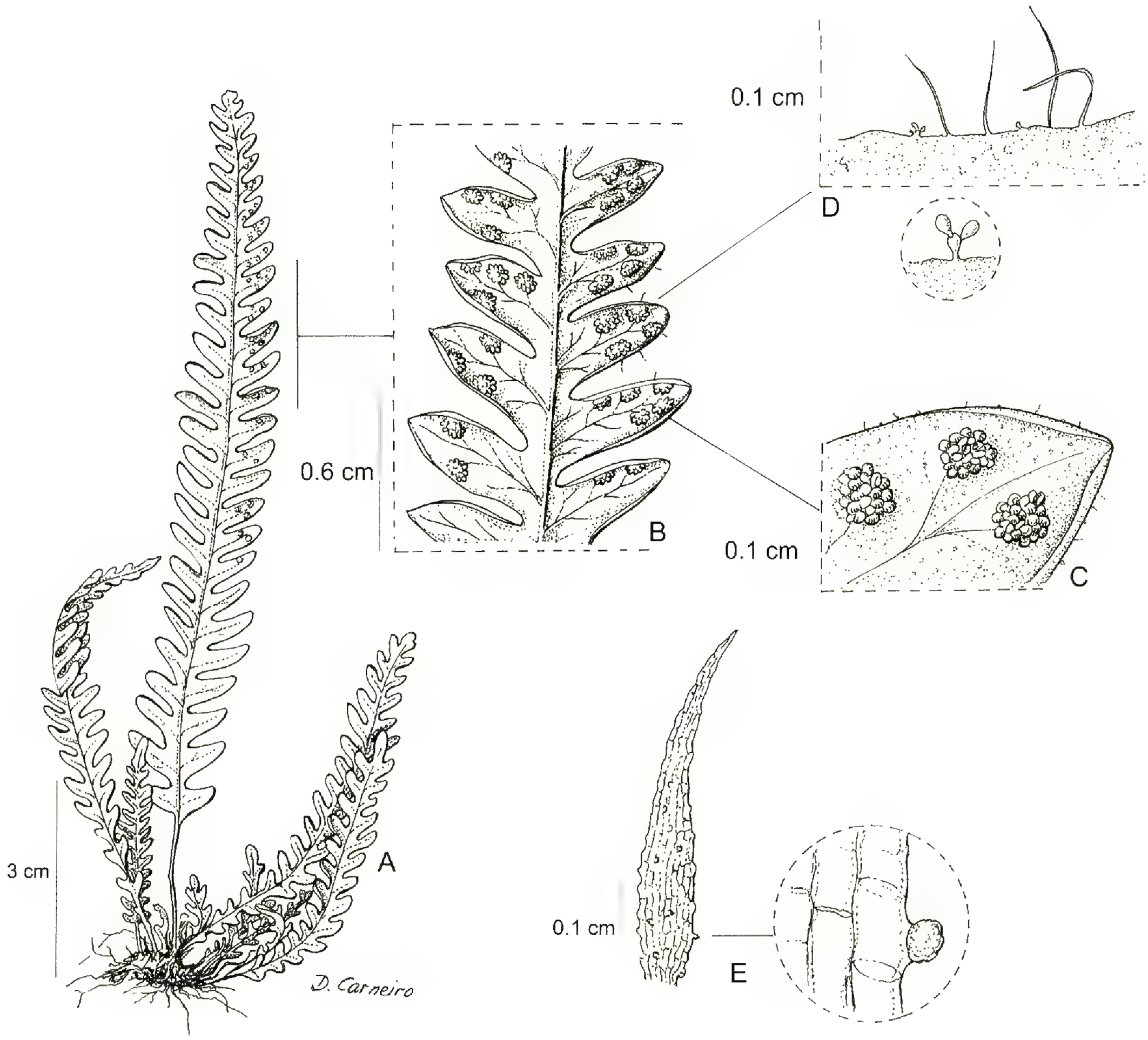

Figure 1. *Ceradenia itatiaiensis* Labiak & Condack. —A. Habit. —B. Laminar detail. —C. Segment detail. —D. Setae and glandular trichomes on laminar margins. —E. Rhizome scale, with short marginal glands. Drawn from the holotype, *Condack 308 & Cortines* (RB).

of its restricted area of occupancy and the apparent small number of individuals in nature.

Etymology. The specific epithet refers to the type locality.

Relationships. *Ceradenia itatiaiensis* is characterized by having linear-lanceolate, pinnatisect laminae; deltate to linear-deltate segments; often slightly revolute margins; basal segments half the length of the middle ones, not reduced to auricles; indument of castaneous setae on stipe and segment margins; and short glandular trichomes with two (rarely three) enlarged globose apical cells on margins and the abaxial side of the laminae. This species is most similar to *C. albidula*, and shares with this species the conspicuous glandular hairs on the abaxial laminae surface. However, *C. albidula* differs by the absence of setae on lamina margins and by its linear-lanceolate laminae, with basal segments often reduced to auricles. *Ceradenia albidula* is also endemic to southeastern Brazil, with a sympatric distribution with *C. itatiaiensis*. Both species occur at high elevations of the Serra do Mar, but *C. itatiaiensis* seems to be much more restricted in its distribution, whereas *C. albidula* is widely distributed in southeastern Brazil.

Paratype. BRAZIL. **Minas Gerais:** Bocaina de Minas, Parque Nacional do Itatiaia, Alto dos Brejos, 1900 m, *J. P. S. Condack, L. S. Sylvestre, C. S. Ramos & D. Monteiro 548* (RB).

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A New Species of *Microtropis* (Celastraceae) from Xizang, China

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ABSTRACT. A new species, *Microtropis xizangensis* Q. W. Lin & Z. X. Zhang, is described and illustrated. This species is similar to *M. discolor* (Wallich) Wallich ex Meisner in having 4-merous flowers and no disk, and differs from it mainly by having 1- to 3-flowered inflorescences, non-carinate petals, and rostrate capsules. The new species is determined as Vulnerable (VU) according to IUCN Red List Categories and Criteria.

Key words: Celastraceae, China, IUCN Red List, *Microtropis*.

The genus *Microtropis* Wallich ex Meisner (Celastraceae) has about 70 species distributed in the warm and tropical regions of eastern Asia, southeastern Asia, and Central America (Hou, 1962). The genus is characterized by its opposite, entire leaves, the cymose or thyrsoid inflorescences, the filiform stipules at the tops of shoots, the 4- to 6-merous bisexual (sometimes unisexual) flowers, the undeveloped disks (sometimes absent) with the stamens marginally inserted, and the laterally splitting capsules with a single seed.

Microtropis xizangensis Q. W. Lin & Z. X. Zhang, sp. nov. TYPE: China. Xizang: Mêdog, Didong nearby, in evergreen forest, 1300 m, 13 Aug. 1974 (fr.), *Qinghai-Tibet Exped. 1813* (holotype, KUN; isotypes, KUN [2], PE). Figure 1.

Species qua ad *Microtropem discolorem* (Wallich) Wallich ex Meisner proxime accedit, sed ab ea inflorescentiis brevibus 1- ad 3-floribus, petalis ecarinatis atque fructibus apice crasse rostratis differt.

Shrubs or small trees, glabrous, 4–7 m tall; branchlets terete, tenuous, yellowish green when young, brown when mature, 1–2 mm diam., internodes 3–6 cm. Leaves ovate, elliptic, or oblong, (5–)8–12(–16) × (2–)3–5(–6) cm, chartaceous, smooth, green adaxially and abaxially, apex narrowly acuminate, caudate, base cuneate, slightly decurrent, margin entire; midrib and lateral veins (5 to 7 pairs) evident on both surfaces, slender, rigid, secondary venation obliquely ascending, arcuate in upper portions, dichotomous at tips, reticulate; petioles canaliculate, 0.3–0.8 cm, 1–2 mm diam. Cymes usually extra-axillary, lateral, short, < 1 cm; peduncles ca. 0.5–0.8 cm, apex forked, generally with 3 close flowers and 2 bracts; bracts minute, ovate, ca. 1 × 0.5 mm broad, apex obtuse or acuminate. Flower buds (immature) small, ca. 1.5 mm, sessile or shortly pediculate, ellipsoid, ca. 1 mm diam., base with 2 bracteoles; bracteoles minute, ovate, ca. 1 mm, apex round or acute; sepals 4, persistent, slightly incrassate in fruiting, imbricate, unequal, the outer 2 semicircular or reniform, coriaceous, margin slightly erose, ca. 0.5 × 1 mm, the inner 2 smaller; petals 4, imbricate, white, elliptic, ca. 1 × 0.4 mm, base and apex round; stamens 4, filaments deltoid, ca. 0.5 mm, base ca. 0.1 mm wide, apex acute, anthers small; disk absent; ovaries conical, ca. 0.5 mm. Capsules large, 1.5–2.5 cm, ca. 1 cm diam., verrucose, globose or elliptic, 1-seeded, base round, apex with long rostra; rostra spiculate, 0.5–1 × ca. 0.2 cm.

Distribution. The new species is narrowly restricted to an often inaccessible area of Mêdog County, Xizang. All specimens examined were collected from the only location known for *Microtropis xizangensis*.

Habitat. Microtropis xizangensis grows in evergreen broadleaf forest at altitudes from 1300 to 2100 m. The holotype population was found in evergreen broadleaf forest at 2040 m; other examined specimens were discovered in forest areas at 1300 m, 1800 m, 2000 m, and 2100 m.

IUCN Red List category. So far there are only seven collections representing *Microtropis xizangensis*, but two of these have noted that this species is common in evergreen broadleaf forest. Considering the largely inaccessible locations and the small number of collections, the population of the new species should not be considered endangered. The total forest area in Mêdog is ca. 21,344 km^2; it is in good condition and far away from human threat. However, in the near future, new road construction could increase human disturbance to the forest. Based on these factors, *M. xizangensis* is determined as Vulnerable (VU) according to IUCN Red List Categories and Criteria (IUCN, 2001).

Phenology. Flowering in May–June; fruiting in August–December.

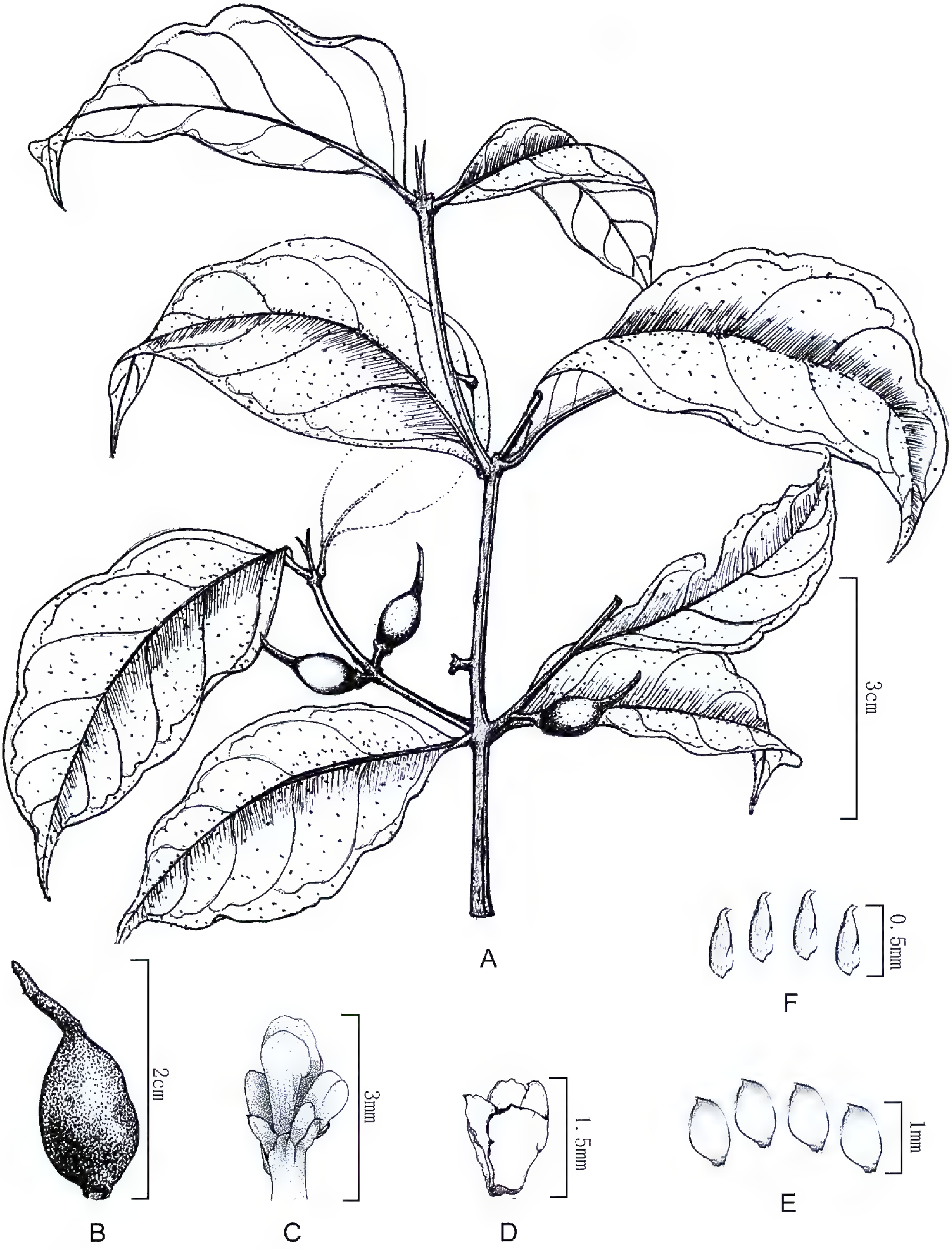

Figure 1. *Microtropis xizangensis* Q. W. Lin & Z. X. Zhang. —A. Fruiting branchlet. —B. Mature fruit. —C. Immature inflorescence. —D. Immature flower. —E. Petals. —F. Immature stamens. Drawn by Quanyi Qiu from the holotype *Qinghai-Tibet Exped. 1813* (KUN) and the paratype *Li, Cheng & Hua 3734* (PE).

Relationships. The new species is similar to *Microtropis discolor* (Wallich) Wallich ex Meisner in having 4-merous flowers and no disk and differs from it mainly by having 1- to 3-flowered inflorescences, non-carinate petals, and rostrate capsules. The two species do not occur in the same region, but are found in a geographically continuous area. *Microtropis discolor* is widely distributed from the eastern part

of India, including Sikkim, West Bengal, and Assam, and East Bengal to Yunnan Province, occurring also in Burma, Laos, Thailand, Vietnam, Cambodia, and Penang, Malaysia, whereas the new species is restricted to Mêdog County, Xizang, China.

Discussion. The name *Microtropis macrophylla* Merrill & F. L. Freeman (1940) was misapplied to the new species, first by Li (1986) and then by Cheng and Kao (1999).

Paratypes. CHINA. **Xizang:** Mêdog County, Didong nearby, 12 Aug. 1974, *Qinghai-Tibet Exped. 3085* (PE); Beibeng, Gelin Station, in evergreen forest, 23 May 1983 (fl.), *B. S. Li, S. Z. Cheng & Z. C. Hua 3734* (PE); 10 Sep. 1974, *Qinghai-Tibet Exped. 2427* (PE); 26 Dec. 1992, *H. Sun, Z. K. Zhou & H. Y. Yu ETM-2637* (KUN); from Gelin to De-er-jiang, 19 May 1983, *B. S. Li & S. Z. Cheng 3627* (PE); Renqinpeng, 22 Apr. 1993, *H. Sun, Z. K. Zhou & H. Y. Yu ETM-5678* (KUN).

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New Combinations for *Arceuthobium aureum* (Viscaceae) in Mexico and Central America

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ABSTRACT. Morphological and molecular analyses of *Arceuthobium aureum* Hawksworth & Wiens and *A. globosum* Hawksworth & Wiens (Viscaceae) demonstrated that these taxa are closely related but can be distinguished based on a few morphological differences, phenology, and host ranges. Therefore, the taxa previously treated under *A. aureum* are recombined under *A. globosum*: *A. globosum* subsp. *aureum* (Hawksworth & Wiens) Mathiasen and *A. globosum* subsp. *petersonii* (Hawksworth & Wiens) Mathiasen.

Key words: *Arceuthobium*, Central America, dwarf mistletoe, Mexico, Viscaceae.

Hawksworth and Wiens described *Arceuthobium globosum* Hawksworth & Wiens (Viscaceae) in 1965 from northern Mexico, but mentioned that this species was widely distributed in Mexico and also occurred in Guatemala and Belize (Hawksworth & Wiens, 1965). In their first monograph of the genus *Arceuthobium* M. Bieberstein (Hawksworth & Wiens, 1972), they emphasized that *A. globosum* was highly variable, and that further field research was needed to determine whether this observed variation warranted finer segregation of this species. They later subdivided *A. globosum* into five taxa as follows (Hawksworth & Wiens, 1977, 1996; Wiens & Shaw, 1994): *A. globosum* subsp. *globosum*, *A. globosum* subsp. *grandicaule* Hawksworth & Wiens, *A. aureum* Hawksworth & Wiens subsp. *aureum*, *A. aureum* subsp. *petersonii* Hawksworth & Wiens, and *A. hawksworthii* Wiens & C. G. Shaw bis. These taxa were primarily distinguished from each other by the size of dominant male or female plants, plant color, host range, geographic distribution, phenology, and their tendency to initiate or not initiate the formation of witches' brooms on their pine hosts.

The taxonomic affinities of the *Arceuthobium globosum* complex have been further substantiated through the molecular work of D. L. Nickrent and his coworkers (Nickrent et al., 1994, 2004). The molecular evidence uncovered so far has shown that *A. globosum* and *A. aureum* cannot be differentiated using ITS DNA or chloroplast *trnL* DNA sequences. Furthermore, Nickrent et al. (2004) demonstrated that *A. hawksworthii* is more closely related to *A. hondurense* Hawksworth & Wiens than to *A. aureum*. After additional morphological measurements and observations of the phenology and host ranges of *A. hawksworthii* and *A. hondurense*, Mathiasen (2007) proposed a new combination for *A. hawksworthii*: *A. hondurense* subsp. *hawksworthii* (Wiens & C. G. Shaw bis) Mathiasen.

Because the *Arceuthobium globosum* group is widespread in Mexico and Central America and represents several of the most economically damaging dwarf mistletoes in these regions (Hawksworth & Wiens, 1972, 1996), I began detailed field studies of the morphology, phenology, geographic distribution, and host range of this important group of dwarf mistletoes in 1998. The molecular and morphological data and observations of phenology support a reclassification of *A. aureum*, and its subspecies, as subspecies of *A. globosum*. These data also support the current classification of the populations of *A. globosum* in central Mexico at the subspecific level (subsp. *grandicaule*). This subspecies extends through southern Mexico and Guatemala into Honduras, and its distribution overlaps with *A. aureum* in southern Mexico (Hawksworth & Wiens, 1996; Melgar et al., 2001; Mathiasen et al., 2003) (Fig. 1). In addition, subspecies *grandicaule* parasitizes some of the same hosts as *A. aureum* (Hawksworth & Wiens, 1996). The distribution of *A. globosum* subsp. *globosum* is confined to northwestern Mexico and does not overlap with subspecies *grandicaule* or *A. aureum*; furthermore, only one of the hosts parasitized by *A. globosum* subsp. *globosum* occurs within the geographic range of *A. globosum* subsp. *grandicaule*, and none occur within the range of *A. aureum* (Hawksworth & Wiens, 1996).

1. **Arceuthobium globosum** Hawksworth & Wiens, Brittonia 17: 223. 1965. TYPE: Mexico. Durango: 1.5 mi. E of El Salto on Hwy. 40, on *Pinus cooperi*, 22 Mar. 1963, *D. Wiens & F. G. Hawksworth 3314* (holotype, COLO; isotypes, MEXU, MO, US). Figure 1, locality 17.

The original collection citation for the type specimen was erroneously published as *F. G. Hawksworth & D. Wiens 3414*, Brittonia 17: 225. 1965.

doi: 10.3417/2007084 NOVON 18: 501–507. PUBLISHED ON 16 DECEMBER 2008.

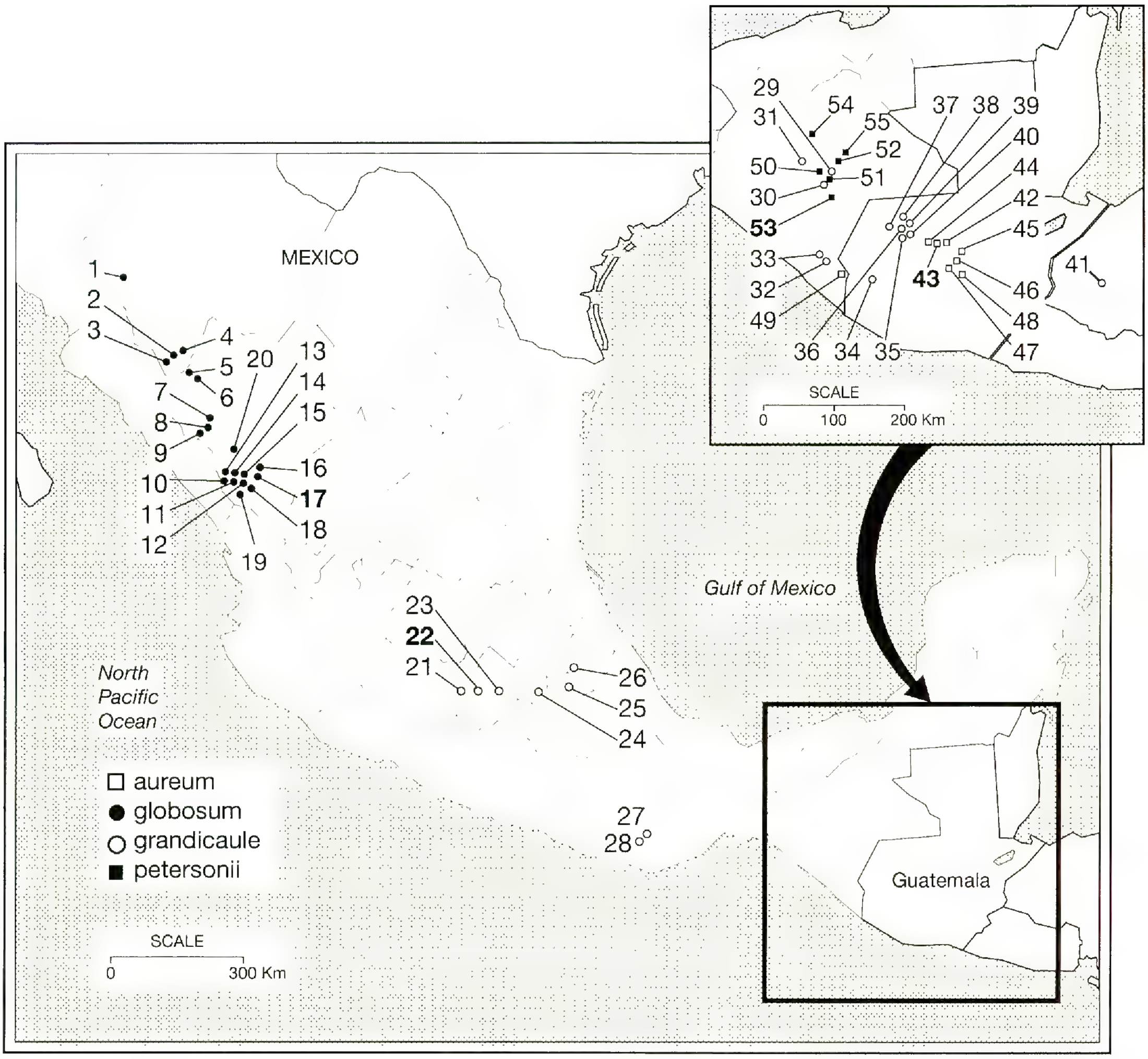

Figure 1. Approximate locations of populations sampled for *Arceuthobium globosum* subsp. *globosum*, (closed circles), *A. globosum* subsp. *grandicaule* (open circles), *A. globosum* subsp. *aureum* (open squares), and *A. globosum* subsp. *petersonii* (dark squares) in Mexico and Central America. Bold numbers represent type localities. *Arceuthobium globosum* subsp. *globosum*: MEXICO. Chihuahua: —1. Ejido Calaveras. —2. Ejido Penito. —3. Cerro Mohinora. —4. El Ocote. Durango: —5. Cocono. —6. 20 km NW of Guanaceví. —7. 15.5 km SW of Altares. —8. 21 km SW of Altares. —9. 40 km SW of Altares. —10. 53 km W of El Salto. —11. 31.5 km W of El Salto. —12. 30 km W of El Salto. —13. 34 km W of El Salto. —14. 22 km W of El Salto. —15. Km post 136 on Mexico Rte. 40. —16. 3.2 km E of El Salto. —**17**. 2.4 km E of El Salto. —18. Ejido El Vriantana. —19. 43 km S of El Salto. —20. 15 km S of San Miguel de las Cruces. *Arceuthobium globosum* subsp. *grandicaule*: MEXICO. Michoacán: —21. 2 km E of San José de la Cumbre. México: —**22**. 35 km E of Zitácuaro. —23. Nevada de Toluca. —24. Llano Grande. Tlaxcala: —25. La Malinche. Puebla: —26. 35 km N of Apizaco. Oaxaca: —27. 35 km S of Miahuatlán. —28. 8 km NW of Suchixtepec. Chiapas: —29. Airport Rd. near San Cristóbal de las Casas. —30. 1.4 km E of jct. of Mexico Rte. 186 and 190 on Rte. 186. —31. 20 km W of San Cristóbal de las Casas. —32. 2.7 km N of La Paz de Rosario. —33. Canada. GUATEMALA. Department San Marcos: —34. Volcán Tajumulco. Department Huehuetenango: —35. 41 km N of Chiantla. —36. 30 km N of Chemal. —37. 5.3 km S of Todos Santos. —38. 21 km N of Santa Eulalia. —39. 18.7 km S of San Juan Ixcoy. —40. 16 km E of Chemal. HONDURAS. —41. Department Lempira: Celaque National Park. *Arceuthobium globosum* subsp. *aureum*: GUATEMALA. Department Alta Verapaz: —42. 3.5 km W of San Cristóbal Verapaz. —**43**. 5 km W of San Cristóbal Verapaz. —44. 8 km W of San Cristóbal Verapaz. —45. 3.3 km E of CA-14 on rd. to Chalisco. Department Baja Verapaz: —46. 5.4 km N of La Cumbre. —47. 1.8 km W of La Cumbre. —48. 1 km S of La Cumbre. MEXICO. Chiapas: —49. El Rosario. *Arceuthobium globosum* subsp. *petersonii*: MEXICO. Chiapas: —50. 0.5 km E of the jct. of Mexico Rte. 186 and 190. —51. 12 km SE of San Cristóbal de las Casas. —52. 18 km E of Rte. 190. —**53**. 52 km SE of San Cristóbal de las Casas. —54. Puebla Nueva. —55. 11 km W of Oxchuc.

1a. Arceuthobium globosum subsp. **globosum**.

Specimens examined. All citations based on *Pinus cooperi* C. E. Blanco, except as noted. MEXICO. **Chihuahua:** 5.5 km S of Calaveras, on *P. durangensis*, 2004 (♂), *Mathiasen 0401* (ASC) (Fig. 1, locality 1); SAGARPA Station, on *P. durangensis*, 2004 (♂), *Mathiasen 0402* (ASC) (Fig. 1, locality 4); 5 km SW of Penito, on *P. durangensis*, 2004 (♂), *Mathiasen 0403* (ASC) (Fig. 1, locality 2); Cerro Mohinora, on *P. durangensis*, 2004 (♂), *Mathiasen 0407* (ASC) (Fig. 1, locality 3). **Durango:** Km post 153 on Mexico Rte. 40, 2003 (♂), *Mathiasen 0301* (ASC), 2005 (♀), *Mathiasen 0541* (ASC) (Fig. 1, locality 10); Km post 136 on Mexico Rte. 40, 2003 (♂), *Mathiasen 0302* (ASC) (Fig. 1, locality 15); 2.4 km E of El Salto on Mexico Rte. 40, 2003 (♂), *Mathiasen 0303* (ASC), 2005 (♀), *Mathiasen 0542* (ASC) (Fig. 1, locality 17); 0.8 km W of Cocono, 2003 (♂), *Mathiasen 0306* (ASC) (Fig. 1, locality 5); 20 km NW of Guanaceví, 2003 (♂), *Mathiasen 0308* (ASC) (Fig. 1, locality 6); 15 km SW of Altares, on *P. durangensis*, 2003 (♂), *Mathiasen 0315* (ASC), 2005 (♀), *Mathiasen 0538* (ASC) (Fig. 1, locality 7), 2003 (♀), *Mathiasen 0316* (ASC); 40 km SW of Altares on rd. to Banome, on *P. durangensis*, 2003 (♂), *Mathiasen 0318* (ASC) (Fig. 1, locality 9); 22 km W of El Salto on Mexico Rte. 40, 2003 (♂), *Mathiasen 0321* (ASC) (Fig. 1, locality 14); 34 km W of El Salto on Mexico Rte. 40, 2003 (♂), *Mathiasen 0323* (ASC) (Fig. 1, locality 13); 30 km W of El Salto on Mexico Rte. 40, 2005 (♀), *Mathiasen 0537* (ASC) (Fig. 1, locality 12); 21.3 km SW of Altares on rd. to Banome, 2005 (♀), *Mathiasen 0539* (ASC) (Fig. 1, locality 8); Ejido El Vriantana, on *P. durangensis*, 2005 (♀), *Mathiasen 0540* (ASC) (Fig. 1, locality 18); 3.2 km E of El Salto on Mexico Rte. 40, 1999 (♂), *Mathiasen 9966* (ASC) (Fig. 1, locality 16); 31.5 km W of El Salto on Mexico Rte. 40, 1999 (♂), *Mathiasen 9969* (ASC) (Fig. 1, locality 11); 43 km S of El Salto on rd. to Pueblo Nuevo, 2007 (♀), *Mathiasen 0711* (ASC) (Fig. 1, locality 19); 15 km S of San Miguel de las Cruces, 2007 (♀), *Mathiasen 0721* (ASC) (Fig. 1, locality 20).

1b. Arceuthobium globosum subsp. **aureum** (Hawksworth & Wiens) Mathiasen, comb. nov. Basionym: *Arceuthobium aureum* Hawksworth & Wiens, Brittonia 29: 414. 1977. TYPE: Guatemala. Alta Verapaz: 5 km W of San Cristóbal Verapaz on Rte. 7W, 1600 m, 7 Feb. 1975, *F. G. Hawksworth, D. Wiens & G. Player 1596* (holotype, US; isotypes, ENCB, INIF, MEXU, MO, UT). Figure 1, locality 43.

Plants 8–31 cm in height (mean ca. 15 cm); basal diam. of dominant plants 3–13 mm (mean ca. 5 mm); third internode length 10–30 mm (mean ca. 17 mm), 2–7 mm (mean ca. 3 mm) wide; staminate and pistillate plants primarily yellow (golden). Staminate flowers 3- and 4-partite, mean diam. of 3-partite flowers 2.2 mm, mean diam. of 4-partite flowers 2.9 mm. Mature fruit length 3.6–4.6 mm (mean 4.1 mm), 2.3–3 mm wide (mean 2.7 mm); seeds 2.1–2.8 (mean 2.4) mm long, 1–1.3 (mean 1.2) mm wide.

Phenology. Anthesis occurs from mid-February through June with no evident peak. Seed dispersal occurs from August to early October, with no clear peak period of dispersal. Anthesis is continuous during the dry season in Guatemala (March–June).

Specimens examined. All citations based on *Pinus maximinoi* H. E. Moore. GUATEMALA. **Alta Verapaz:** 3.5 km W of San Cristóbal Verapaz on Rte. 7W, 1999 (♂ & ♀), *Mathiasen 9919* (ASC) (Fig. 1, locality 42); 3.3 km E of CA-14 on rd. to Chalisco, 2006 (♂ & ♀), *Mathiasen 0622* (ASC) (Fig. 1, locality 45); 5 km W of San Cristóbal Verapaz on Rte. 7W, 2006 (♂ & ♀), *Mathiasen 0623* (ASC) (Fig. 1, locality 43); 8 km W of San Cristóbal Verapaz on Rte. 7W, 2000 (♂ & ♀), *Mathiasen 0006* (ASC) (Fig. 1, locality 44). **Baja Verapaz:** 1 km S of La Cumbre on Rte. CA-14, 1999 (♂ & ♀), *Mathiasen 9916* (ASC), 2006 (♂ & ♀), *Mathiasen 0621* (ASC) (Fig. 1, locality 48); 5.4 km N of La Cumbre on Rte. CA-14, 1999 (♂ & ♀), *Mathiasen 9917* (ASC) (Fig. 1, locality 46); 1.8 km W of La Cumbre on rd. to Soloma, 2000 (♂ & ♀), *Mathiasen 0005* (ASC) (Fig. 1, locality 47). MEXICO. **Chiapas:** Km 43 on Mexico Rte. 200 near Motozintla, 2002 (♂ & ♀), *Mathiasen 0203* (ASC) (Fig. 1, locality 49).

1c. Arceuthobium globosum subsp. **petersonii** (Hawksworth & Wiens) Mathiasen, comb. nov. Basionym: *Arceuthobium aureum* Hawksworth & Wiens subsp. *petersonii* Hawksworth & Wiens, Brittonia 29: 415. 1977. TYPE: Mexico. Chiapas: near Km 136 on Panamerican Hwy., 52 km SE of San Cristóbal de las Casas, on *Pinus pseudostrobus*, 2250 m, 8 Feb. 1975, *F. G. Hawksworth, D. Wiens & G. Player 1598* (holotype, US; isotypes, ENCB, INIF, MEXU, MO, UT). Figure 1, locality 53.

Plants 18–46 cm in height (mean ca. 30 cm); basal diam. of dominant plants 4–23 mm (mean ca. 10 mm); third internode length 9–38 mm (mean ca. 24 mm), 3–16 mm (mean ca. 6 mm) wide; staminate and pistillate plants yellow-brown. Staminate flowers 3- and 4-partite, mean diam. of 3-partite flowers 2.2 mm, mean diam. of 4-partite flowers 3 mm. Mature fruit length 4.5–5.7 mm (mean 5.1 mm), 2.9–4 mm wide (mean 3.4 mm); seeds 2.4–3.2 (mean 2.9) mm long and 1.2–1.6 (mean 1.4) mm wide.

Phenology. Anthesis occurs from mid-August through early October with a peak in mid-September. Seed dispersal occurs from mid-August to early October with a peak in mid-September.

Discussion. My field observations and plant measurements of three *Arceuthobium globosum* populations near San Miguel Suchixtepec, Oaxaca, Mexico, indicate these populations are representative of subspecies *grandicaule* and not subspecies *petersonii*. Male plants of these populations were not flowering in September 2006, which is further evidence that these populations are not subspecies *petersonii*. Therefore, further fieldwork is needed in Oaxaca to determine if

subspecies *petersonii* occurs there as reported by Hawksworth and Wiens (1977, 1996).

Specimens examined. All citations based on *Pinus pseudostrobus* Lindley, except as noted. MEXICO. **Chiapas:** 0.5 km E of jct. of Mexico Rte. 186 & 190 on Rte. 186, 2002 (♂ & ♀), *Mathiasen 0201* (ASC) (Fig. 1, locality 50); 52 km SE of San Cristóbal de las Casas (at Km 136) on Rte. 190, 2000 (♂ & ♀), *Mathiasen 0008* (ASC), 2002 (♂ & ♀), *Mathiasen 0212* (ASC), 2005 (♂ & ♀), *Mathiasen 0573* (ASC), 2006 (♂ & ♀), *Mathiasen 0638* (ASC) (Fig. 1, locality 53); 2.1 km N of Puebla Nueva, on *P. maximinoi*, 2002 (♂ & ♀), *Mathiasen 0208* (ASC) (Fig. 1, locality 54); 11 km W of Oxchuc on Mexico Rte. 186, 2000 (♂ & ♀), *Mathiasen 0018* (ASC) (Fig. 1, locality 55); 12 km SE of San Cristóbal de las Casas, 2006 (♂ & ♀), *Mathiasen 0639* (ASC) (Fig. 1, locality 51); 18 km E of Rte. 190 on Rte. 186, on *P. montezumae* A. B. Lambert, 2006 (♂ & ♀), *Mathiasen 0640* (ASC) (Fig, 1, locality 52).

1d. Arceuthobium globosum subsp. **grandicaule** Hawksworth & Wiens, Brittonia 29: 413. 1977. TYPE: Mexico. México: Km 59 on Hwy. 15, 35 km E of Zitácuaro, 2600 m, on *Pinus montezumae*, 13 Feb. 1975, *F. G. Hawksworth & G. Player 1607* (holotype, US; isotypes, ENCB, FPF, INIF, MEXU, MO, UT). Figure 1, locality 22.

Specimens examined. All citations based on *Pinus pseudostrobus*, except as noted. GUATEMALA. **Huehuetenango:** 30 km N of Chemal on rd. to Soloma, on *P. hartwegii*, 1999 (♂), *Mathiasen 9921* (ASC) (Fig. 1, locality 36); 5.3 km S of Todos Santos, 1999 (♂), *Mathiasen 9922* (ASC) (Fig. 1, locality 37); 41 km N of Chiantla on rd. to Soloma, on *P. hartwegii*, 1999 (♂), *Mathiasen 9925* (ASC) (Fig. 1, locality 35); 21 km N of Santa Eulalia on rd. to Barillas, on *P. hartwegii*, 1999 (♂), *Mathiasen 9929* (ASC) (Fig. 1, locality 38); 18.7 km S of San Juan Ixcoy on rd. to Soloma, on *P. hartwegii*, 1999 (♂), *Mathiasen 9930* (ASC) (Fig. 1, locality 39); 16 km E of Barillas rd. near Chemal, on *P. hartwegii*, 2000 (♂), *Mathiasen 0005* (ASC) (Fig. 1, locality 40). **San Marcos:** ca. 5 km W of Villa Nueva on Volcán Tajumulco, on *P. hartwegii*, 1999 (♂), *Mathiasen 9927* (ASC) (Fig. 1, locality 34). HONDURAS. **Lempira:** summit of Cerro Las Minas, Celaque Natl. Park, on *P. hartwegii*, 2000 (♂), *Mathiasen 0054* (ASC) (Fig. 1, locality 41). MEXICO. **Chiapas:** 1.4 km E of jct. of Rte. 186 & 190 on Rte. 186, 2000 (♀), *Mathiasen 0022* (ASC) (Fig. 1, locality 30); 2.7 km N of La Paz de Rosario, 2002 (♀), *Mathiasen 0204* (ASC) (Fig. 1, locality 32); 0.2 km N of Canada, 2002 (♀), *Mathiasen 0207* (ASC) (Fig. 1, locality 33); 20 km W of San Cristóbal de las Casas on Mexico Rte. 190, 2002 (♀), *Mathiasen 0211* (ASC) (Fig. 1, locality 31); 1.1 km W of Mexico Rte. 186 on airport rd., 2002 (♀), *Mathiasen 0214* (ASC) (Fig. 1, locality 29). **México:** 35 km E of Zitácuaro on Mexico Rte. 59, on *P. montezumae*, 1998 (♀), *Mathiasen 98142* (ASC) (Fig. 1, locality 22); 1.5 km S of Railes on rd. to Nevada de Toluca, on *P. hartwegii*, 1998 (♀), *Mathiasen 98144* (ASC) (Fig. 1, locality 23); 4 km S of Llano Grande, on *P. hartwegii*, 2001 (♂), *Mathiasen 0114* (ASC), 2005 (♀), *Mathiasen 0550* (ASC) (Fig. 1, locality 24). **Michoacán:** 26 km E of Morelia on Mexico Rte. 15, 1998 (♀), *Mathiasen 98143* (ASC) (Fig. 1, locality 21). **Oaxaca:** 35 km S of Miahuatlán on Mexico Rte. 175, 2006 (♀), *Mathiasen 0645* (ASC) (Fig. 1, locality 27); 8 km NW of San Miguel Suchixtepec on Mexico Rte. 175, 2006 (♀), *Mathiasen 0644* (ASC) (Fig. 1, locality 28). **Puebla:** 35 km N of Apizaco, on *P. hartwegii*, 2005 (♀), *Mathiasen 0549* (ASC) (Fig. 1, locality 26). **Tlaxcala:** La Malinche, on *P. hartwegii*, 2001 (♂), *Mathiasen 0115* (ASC), 2005 (♀), *Mathiasen 0548* (ASC) (Fig. 1, locality 25).

Morphology. Twenty populations of subspecies *globosum* were measured from northern Mexico; 13 populations of subspecies *grandicaule* were measured from central and southern Mexico, seven from Guatemala, and one from Honduras; seven populations of subspecies *aureum* were measured from Guatemala and one from southern Mexico; and six populations of subspecies *petersonii* were measured from Chiapas, Mexico (Fig. 1). These populations included the type locality for each taxon as well as several populations not previously sampled by Hawksworth and Wiens (1965, 1977, 1996). For each population, 10 or 20 male and 10 or 20 female plants were collected and the largest shoot from each collection was used for morphological measurements. Plant measurements were made within 24 hours of collection.

The dwarf mistletoe characters measured were those used by Hawksworth and Wiens (1996) for taxonomic classification: (1) height, basal diameter, third internode length and width, and color of the tallest male and female shoot from each infection collected; (2) mature fruit length, width, and color; (3) seed length, width, and color; (4) staminate flower diameter for flowers with three perianth lobes and four perianth lobes, respectively; (5) number, color of the adaxial surface, and length and width of staminate perianth lobes; (6) anther distance from the perianth lobe tip; and (7) anther diameter. At least 100 measurements were made for mature fruits and staminate flowers. In addition, the width of the terminal staminate spike was measured because this character distinguishes *Arceuthobium globosum* from *A. aureum* (Hawksworth & Wiens, 1977).

The principal morphological differences between the subspecies of *Arceuthobium globosum* were plant dimensions, plant color, staminate flower diameter, and staminate spike width (Table 1, Appendices A and B; appendices available online at http://www.for.nau.edu/SOFArchive/Faculty/RLMathiasen/080529-01.pdf). Both male and female plants of subspecies *grandicaule* were the largest of the subspecies and those of subspecies *aureum* were the smallest. Plants of subspecies *globosum* and *petersonii* were intermediate in height, basal diameter width, and third internode dimensions. The primary morphological characteristics distinguishing subspecies *grandicaule* from the other subspecies were its very large plants and shoot color. It

Table 1. Principal morphological and physiological differences between the subspecies of *Arceuthobium globosum*. Measures are expressed as mean (range) values.

Characters	*A. globosum* subsp. *globosum*	*A. globosum* subsp. *grandicaule*	*A. globosum* subsp. *aureum*	*A. globosum* subsp. *petersonii*
Plant height (cm)				
Male plants				
Mean	21 (11–42)	45 (17–93)	15 (8–31)	32 (19–46)
Female plants				
Mean	20 (8–45)	38 (17–66)	14 (8–22)	27 (18–46)
Basal diameter (mm)				
Male plants				
Mean	11 (5–32)	16 (6–37)	5 (3–13)	10 (4–23)
Female plants				
Mean	13 (4–26)	18 (6–40)	6 (3–13)	13 (7–20)
Width of terminal staminate spike (mean, mm)	1.9	2.0	1.2	1.1
Mean staminate flower diameter (mm)				
3 lobes/flower	3.1	3.1	2.2	2.2
4 lobes/flower	4.2	4.2	2.9	3.0
Mean fruit length (mm)	6.7	7.0	4.1	5.1
Mean fruit width (mm)	4.1	4.1	2.7	3.4
Plant color	yellow	yellow-green	yellow (golden)	yellow-brown
Witches' brooms formed	rarely	frequently	frequently	frequently
Peak flowering	March–April	March–April	February–June	September
Peak seed dispersal	June–July	mid-August–mid-September	August–October	September
Distribution	northwest Mexico	central and southern Mexico, Guatemala, and Honduras	Chiapas, Mexico, and Guatemala	Chiapas, Mexico

consistently had male and female plants larger than 40 cm in length, the basal diameter of plants was typically greater than 1.5 cm, and its third internode dimensions were much larger than the other subspecies (Appendices A and B). While the color of male and female plants varied and overlapped to some extent, plants of subspecies *grandicaule* were yellow-green, plants of subspecies *globosum* and *aureum* were usually yellow (golden), and those of subspecies *petersonii* were yellow-brown. However, many male plants of subspecies *grandicaule* in Guatemala were also yellow-brown, but the large size, basal diameters, third internode dimensions, and staminate spike widths of the Guatemalan plants were characteristic of subspecies *grandicaule*. Furthermore, male plants in these populations flowered in March, not September.

The mean diameters of staminate flowers for subspecies *globosum* and *grandicaule* were the same; this was true for both 3- and 4-partite flowers (Table 1). The mean diameters of staminate flowers for subspecies *aureum* and *petersonii* were also the same, but were much smaller than the staminate flowers of subspecies *globosum* and *grandicaule* (Table 1). The mean diameter of staminate flowers was one of the most consistent morphological differences that distinguished subspecies *globosum* and *grandicaule* from subspecies *aureum* and *petersonii*. The mean length and width of fruits of subspecies *globosum* and *grandicaule* were similar, but the fruits of subspecies *petersonii* and *aureum* were consistently smaller. However, the fruits of subspecies *petersonii* were slightly larger than those of subspecies *aureum* (Table 1). Seed dimensions were nearly the same for all four subspecies. Another consistent morphological character that separated subspecies *globosum* and *grandicaule* from subspecies *aureum* and *petersonii* was the width of terminal staminate spikes (Hawksworth & Wiens, 1977). This width was consistently smaller for subspecies *aureum* and *petersonii*; when staminate plants of the four subspecies were compared, this character easily distinguished subspecies *globosum* and *grandicaule* from subspecies *aureum* and *petersonii* (Table 1, Appendix A).

Phenology. Hawksworth and Wiens (1977, 1996) indicated one of the principal physiological differences between the subspecies of *Arceuthobium globosum* was their periods of anthesis and seed dispersal. Therefore, I made additional observations of flowering and seed dispersal from 1999 to 2007. The flowering periods of subspecies *globosum*, *grandicaule*, and *aureum* overlap in the spring (March–May), but subspecies *grandicaule* starts flowering as early as January in central Mexico and subspecies *aureum* continues flowering into June in Guatemala. While the duration of flowering for subspecies

petersonii is still not well established, my observations and those of Hawksworth and Wiens indicate its peak flowering period is consistently in the late summer (September), and not during the spring. Hawksworth and Wiens (1977, 1996) reported that subspecies *aureum* flowers continuously during the dry season (February–May) in Guatemala. My observations of subspecies *aureum* support this, and I found that it flowers well into June. Peak flowering periods for subspecies *globosum* and *grandicaule* are consistently during March. The peak seed dispersal period for subspecies *globosum* is in July (Hawksworth & Wiens, 1996), while the peak seed dispersal for subspecies *grandicaule* is from mid-August to mid-September (Escudero & Cibrián, 1985) in central Mexico. Its peak for seed dispersal in Guatemala is from July to September. Hawksworth and Wiens (1977, 1996) reported that subspecies *petersonii* reached its peak of seed dispersal in June–July, but I found that it peaks in September–October. There is no distinctive peak for seed dispersal of subspecies *aureum* in Guatemala, and female plants were found with some mature fruits whenever observations were made there.

Host susceptibility. *Arceuthobium globosum* subsp. *aureum* is parasitic principally on *Pinus maximinoi* in Guatemala. Although it has been reported to parasitize *P. pseudostrobus*, *P. montezumae*, *P. pseudostrobus* var. *apulcensis* (Lindley) Shaw (*P. oaxacana* Mirov), and *P. oocarpa* Schiede ex Schlechtendal in Guatemala (Hawksworth & Wiens, 1977, 1996), I have not observed it on these hosts there. Furthermore, my observations in Guatemala indicate *P. oocarpa* is not susceptible to infection, and therefore, additional observations and field data are needed to clarify the host range of subspecies *aureum* in Guatemala.

In Chiapas, subspecies *petersonii* is parasitic principally on *Pinus pseudostrobus* and *P. montezumae*. My observations at two sites in Chiapas indicate that subspecies *petersonii* does not infect *P. maximinoi*, but this pine is the principal host of subspecies *aureum* in Guatemala. Although *P. oocarpa*, *P. pseudostrobus* var. *apulcensis* (*P. oaxacana*), and *P. devoniana* Lindley (*P. michoacana* Martínez) have been reported to be principal hosts of subspecies *petersonii* in Chiapas (Hawksworth & Wiens, 1996), they are much less susceptible than *P. pseudostrobus* and *P. montezumae*. However, I do not have enough quantitative data on the susceptibility of these pines to place them into the susceptibility classes used by Hawksworth and Wiens (1996). Hawksworth and Wiens (1996) reported that *P. patula* Schiede ex Schlechtendal & Chamisso was a principal host of subspecies *petersonii*, but I have not observed infection on this host. Further fieldwork is also needed to clarify the host range and host susceptibility of pines to subspecies *petersonii* in Chiapas.

Most of the hosts of subspecies *grandicaule* do not occur in the geographic range of subspecies *globosum* and vice versa (Perry, 1991; Farjon & Styles, 1997). Only *Pinus durangensis* Martínez is severely parasitized by both subspecies *globosum* and *grandicaule*. While *P. teocote* Schlechtendal & Chamisso has been reported as a principal host of subspecies *grandicaule*, this pine has only been reported to be rarely infected by subspecies *globosum* (Hawksworth & Wiens, 1996).

Although Hawksworth and Wiens (1977, 1996) noted that subspecies *aureum* did not induce the formation of witches' brooms and that subspecies *petersonii* only did so occasionally, I observed that both of these mistletoes consistently caused the formation of witches' broom on their principal hosts in Guatemala and Chiapas, Mexico. Hawksworth and Wiens (1996) also reported that subspecies *globosum* seldom initiated the formation of witches' brooms on its hosts, but that subspecies *grandicaule* consistently induced brooms. My observations supported that subspecies *grandicaule* consistently induced broom formation. Although subspecies *globosum* usually did not initiate the formation of brooms on its pine hosts, it rarely induced witches' broom formation on *Pinus cooperi* in Durango, Mexico.

Molecular data. Maximum parsimony analysis of nuclear ribosomal ITS sequences and chloroplast *trnL* region sequences demonstrated that subspecies *globosum*, *grandicaule*, *aureum*, and *petersonii* cannot be distinguished from each other using these molecular regions (Nickrent et al., 2004). The close affinity of these taxa is also supported by the small p-distances between the samples of these taxa generated from molecular data using PAUP analysis (Swofford, 2002; Nickrent, unpublished data).

Originally, Hawksworth and Wiens treated all of the populations representing *Arceuthobium globosum* and *A. aureum* under *A. globosum* (Hawksworth & Wiens, 1972). They later segregated these populations based on plant size, color, phenology, and distribution (Hawksworth & Wiens, 1977, 1996). The populations of *A. globosum* currently treated as distinct species by Hawksworth and Wiens have a few consistent morphological differences between them (Table 1), have different flowering and seed dispersal periods, and parasitize different hosts to some degree. However, they have many similar morphological characteristics, have similar ITS and *trnL* region DNA sequences, and are capable of parasitizing some of the same hosts, all of which clearly demonstrate that these mistletoes are closely related. Hawksworth

and Wiens (1996: 146) defined subspecies in *Arceuthobium* as "geographically restricted populations delimited by a few relatively small but consistent variations." Although the distribution of subspecies *grandicaule* overlaps with subspecies *petersonii* around San Cristóbal de las Casas, Chiapas, subspecies *grandicaule* consistently flowers in March and subspecies *petersonii* flowers in September there. Because of the morphological and physiological differences I detected between subspecies *globosum*, *grandicaule*, *aureum*, and *petersonii*, the classification of these populations as subspecies of *A. globosum* is the most consistent classification based on Hawksworth and Wiens' concept of subspecies in *Arceuthobium*. Differences in plant size, phenology, and distribution have been the principal characters used by Hawksworth et al. (1992) and Hawksworth and Wiens (1996) to separate subspecies. Therefore, the classification for *A. aureum* and *A. aureum* subsp. *petersonii* as subspecies of *A. globosum* is more consistent with the taxonomic framework established by Hawksworth and Wiens for *Arceuthobium* than treating *A. aureum* as a distinct species.

Key to the Subspecies of *Arceuthobium globosum* in Mexico and Central America

1a. Plants yellow or green; staminate spike ca. 2 mm wide near apex; staminate flowers 3–4 mm diam.; distributed in northern and central Mexico.
  2a. Plants yellow, forming globose clusters of shoots; plant height usually 15–25 cm, basal diameter of plants ca. 1 cm; witches' brooms rarely formed on host pines; Durango and Chihuahua, Mexico. . *A. globosum* subsp. *globosum*
  2b. Plants yellow-green, base of old plants dark brown; plant height usually 35–50 cm; basal diameter of plants ca. 2 cm; witches' brooms commonly formed on host pines . . . . . *A. globosum* subsp. *grandicaule*
1b. Plants golden to yellow-brown; staminate spike usually ca. 1 mm wide near apex; staminate flowers 2–3 mm diam.; distributed in Chiapas, Mexico, and Guatemala.
  3a. Plants golden to bright yellow; plant height usually 10–20 cm; mature fruits ca. 4 × 2.7 mm; flowering from February to June; parasitic primarily on *Pinus maximinoi*; distributed in central Guatemala, but also known from southern Chiapas, Mexico . . . . . *A. globosum* subsp. *aureum*
  3b. Plants yellow-brown; plant height usually 25–40 cm; mature fruits ca. 5 × 3.4 mm; flowering and seed dispersal in September; parasitic primarily on *Pinus pseudostrobus*; distributed in central Chiapas, Mexico. . . . . *A. globosum* subsp. *petersonii*

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A New Combination in *Clinopodium* (Lamiaceae) from Mesoamerica and Cuba

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Abstract. *Micromeria brownei* var. *ludens* Shinners is recognized at the rank of species and transferred to *Clinopodium* L. Shinners distinguished variety *ludens* from other *M. brownei* (Swartz) Bentham based on its "hispid-ciliate" calyx teeth. While this character seems to be variable over the entire geographic range of *C. brownei* (Swartz) Kuntze, *C. ludens* (Shinners) A. Pool is unique in possessing narrowly ellipsoid nutlets, which are apically rostrate, supporting its recognition at the species level. The generic transfer from *Micromeria* Bentham to *Clinopodium* follows the molecular and morphological studies of Cantino and Wagstaff. *Clinopodium ludens* is currently known from Pinar del Río Province of Cuba, the Yucatán and Quintana Roo states of Mexico, and the Atlántida Department of Honduras.

Key words: *Clinopodium*, Cuba, Lamiaceae, Mesoamerica, *Micromeria*, *Satureja*.

Treatment of New World species sometimes included in *Micromeria* Bentham has been a subject of great controversy. Some 20th-century botanists, such as Epling (1940, 1964), Epling and Játiva (1966), Adams (1972), and Standley and Williams (1973), have treated these species within a very broad concept of *Satureja* L., in Epling (1964) and Epling and Játiva (1966) within sections *Hesperothymus* (Bentham) Briquet and *Xenopoma* (Willdenow) Briquet; Shinners (1962) and Morales (1993) placed these species in *Micromeria*, in Morales (1993) in sections *Hesperothymus* Bentham and *Xenopoma* (Willdenow) Bentham. Doroszenko (1985) divided *Satureja* s.l. into 17 genera, with *Satureja* s. str. and *Micromeria* s. str. restricted to the Old World, and the New World species of *Micromeria* treated at the genus level as *Xenopoma* Willdenow and, based on *Micromeria* sect. *Hesperothymus*, "Hesperothymus (Bentham) Doroszenko" (unpublished name; Doroszenko, 1985: 407). Wagstaff et al. (1995) included representatives of nine of the 17 genera recognized by Doroszenko (1985) in their cladistic analysis of chloroplast DNA restriction site data in subfamily Nepetoideae, including *Satureja* s. str., *Micromeria* s. str., and *Micromeria* sect. *Hesperothymus*. They found that most of the genera composing *Satureja* s.l. fell into an unresolved polytomy, which also included such distinctive genera as *Monarda* L. and *Monardella* Bentham, but excluded *Satureja* s. str. and *Micromeria* s. str., making it impossible, on cladistic grounds, to accept a broad concept of *Satureja* or *Micromeria* without submerging *Monarda* and *Monardella*. Cantino and Wagstaff (1998) reexamined the species of *Satureja* s.l. in light of the molecular study (Wagstaff et al., 1995) in combination with some herbarium studies and concluded that *Satureja* and *Micromeria* should be treated more narrowly and restricted to the Old World. Cantino and Wagstaff (1998) considered, based on morphological study, recognition of the other genera proposed by Doroszenko, but concluded that for the New World, only the monotypic genus *Obtegomeria* Doroszenko & P. D. Cantino of South America could be recognized; the other groups lack probable synapomorphies, intergrade by way of intermediate species, or both (Cantino & Wagstaff, 1998). While suggesting that more molecular work is needed to fully resolve the relationships in this group, they proposed that the remaining New World species should be treated as *Clinopodium* and provided a list of accepted names, with some synonymy, for the North American species. Harley and Granda (2000) provided a similar list for the tropical American species.

Clinopodium brownei (Swartz) Kuntze and *C. douglasii* (Bentham) Kuntze have generally been placed together, sometimes under or with synonyms (and sometimes additional taxa) in *Micromeria* sect. *Hesperothymus* (Bentham, 1834; Morales, 1993), *Satureja* sect. *Hesperothymus* (Briquet, 1896; Epling & Játiva, 1966), or "Hesperothymus" (Doroszenko, 1985), based, when indicated, on the long pedicels (Bentham, 1834) or the habit (herbaceous, prostrate or repent) and the flowers borne on long pedicels or peduncles and usually solitary in the leaf axils (Epling & Játiva, 1966; Doroszenko, 1985), characters also found in the proposed *C. ludens* (Shinners) A. Pool. Cantino and Wagstaff (1998) hypothesized recognition of the section *Hesperothymus* of *Micromeria* at the genus level with possible synapomorphies: prostrate

herbaceous habit, solitary long-pedunculate flowers, and broadly ovate to subrotund leaves. They compared *Micromeria* sect. *Hesperothymus* to Doroszenko's generic concept of *Xenopoma* (Doroszenko, 1985), which included the unpublished transfer of the species *S. ganderi* Epling (Doroszenko, 1985: 429), and found *S. ganderi* (= *Clinopodium ganderi* (Epling) Govaerts) to be a "bridge" (Cantino & Wagstaff, 1998: 67) between Doroszenko's concepts of "Hesperothymus" and *Xenopoma*, as it has leaves that resemble those of "Hesperothymus" and flowers that are sometimes long-pedunculate and solitary in the leaf axils, but is a shrub, as are most species of *Xenopoma*. The only remaining synapomorphy for Doroszenko's "Hesperothymus" would be the prostrate herbaceous habit, and this is found in other species recognized by him as *Xenopoma* (Doroszenko, 1985: 421), e.g., *S. tenella* Epling (= *Clinopodium tenellum* (Epling) Harley) (Cantino & Wagstaff, 1998). This led Cantino and Wagstaff (1998) to hypothesize that Doroszenko's "Hesperothymus" arose within *Xenopoma* and that to recognize it at the genus level would render *Xenopoma* paraphyletic. Doroszenko (1985) admitted that his ined. "Hesperothymus" was weakly defined at the genus level and did not strongly endorse this interpretation. Additionally, Doroszenko's phenogram 9 (1985: 512) shows the species he recognized in three separate genera, *Xenopoma*, *Diodeilis* Rafinesque, and his ined. "Hesperothymus," to be totally intermingled. Therefore, it seems best at this time to follow the leads of Cantino and Wagstaff (1998) and Harley and Granda (2000), accept the generic placement of *C. brownei*, and transfer the similar *M. brownei* var. *ludens* Shinners to *Clinopodium*.

Clinopodium ludens (Shinners) A. Pool, comb. et stat. nov. Basionym: *Micromeria brownei* (Swartz) Bentham var. *ludens* Shinners, Sida 1: 96. 1962. TYPE: Cuba. Prov. Pinar del Río: wayside near Sabicú, Rangel, Sierra del Rosario, Jan. 1957, *Bro. Alain [Liogier] 6137* (holotype, NY).

Clinopodium ludens is similar to *C. brownei* in many aspects: they are both trailing to ascending, rhizomatous herbs with broadly ovate leaves, with floral cymes reduced to a single flower (or rarely two in *C. ludens*), the peduncle not developed, and the bractlet absent. In addition, they have flowers with the calyx tubes and teeth similar in size and shape, both with tubes internally annulate at the mouth, and corollas similar in shape and color. However, in the course of examining material of *C. brownei* for the Flora Mesoamericana Project, I noted that specimens from the Yucatán and Atlantic Honduras have a longer and narrower fruiting calyx than material from other areas, and the nutlets of these specimens are narrowly ellipsoid with a broad, dorsal-ventrally compressed apical rostrum, quite different in appearance from all other nutlets of *C. brownei*, which are broadly obloid with a rounded apex. They also differ from *C. brownei*, as represented in Mesoamerica, by having longer petioles (3–15 mm vs. 0.5–3 mm), shorter pedicels (1.75–5 mm vs. 5–15 mm), corolla tubes equal in length or shorter than the calyx (vs. longer than the calyx), and the calyx teeth strongly ciliate (vs. glabrous to ciliate). While these last characters vary over the geographic range of *C. brownei* as currently, if somewhat unsatisfactorily, delineated by Pool in an upcoming volume of *Flora Mesoamericana* (southeastern United States, Mexico, Guatemala, Colombia, Venezuela, Ecuador, Brazil, Paraguay, the Bahama Islands, Jamaica, and Hispaniola), these differences, in addition to the very distinctive nutlets, support recognition of *C. ludens* at the species level. *Clinopodium ludens* is currently known from Pinar del Río Province of Cuba, the Yucatán and Quintana Roo states of Mexico, and the Atlántida Department of Honduras. It is also grown in home gardens in Quintana Roo (*Pulido & Serralta 650*, MEXU) and Yucatán, where it is sometimes referred to as "poleo" (*Ankli AANK044*, MEXU), and where it is used medicinally (*Vargas & Sima 350*, MEXU). In addition, it is grown in Honduras by the Xicaques de la Montaña de La Flor (*Molina 3020*, F) and in hanging baskets (*Standley & Chacón 7177*, F).

Recognition of this taxon was first suggested by Hemsley (1887: 107), who added *Micromeria brownei* "forma calyce angustiore" to the Supplement of *Biologia Centrali-Americana* based on F. Gaumer's (s.n., BM) collection from Cozumel Island, located off the coast of the Yucatán. Shinners described *M. brownei* var. *ludens* in 1962, with the holotype from Cuba, one paratype from Cuba, and two paratypes from the Yucatán (all examined in the course of this study). He distinguished it from typical *M. brownei* (which Shinners recognized as endemic to Jamaica) and *M. brownei* var. *pilosiuscula* A. Gray (treated by Shinners from the southeastern United States, Mexico, and Guatemala, and treated by Pool, in an upcoming volume of the *Flora Mesoamerica*, as a synonym of *Clinopodium brownei*) by its "hispid-ciliate" calyx teeth (Shinners, 1962: 94) with hairs 0.3–0.6 mm long, versus calyx teeth glabrous to ciliate with hairs about 0.1 mm long. Neither Epling and Játiva (1966) nor Doroszenko (1985) mention either *M. brownei* var. *ludens* or *M. brownei* "forma calyce angustiore" (Hemsley, 1887: 107).

KEY SEPARATING *CLINOPODIUM LUDENS* FROM MESOAMERICAN REPRESENTATIVES OF *C. BROWNEI*

1a. Nutlets broadly obloid, width more than half length, non-rostrate; petioles 0.5–3 mm; pedicels 5–15 mm; corolla tube longer than calyx . . . . *C. brownei*

1b. Nutlets narrowly ellipsoid, width less than half length, apically rostrate, the rostrum dorsal-ventrally compressed; petioles 3–15 mm; pedicels 1.75–5 mm; corolla tube equaling or shorter than calyx . . . . *C. ludens*

Additional specimens examined. CUBA. Santiago de las Vegas Habana, cultivated Est. Exp. Agronomica, *J. Acuna 19539* (NY). HONDURAS. **Atlántida:** Lancetilla Valley, near Tela, *P. C. Standley 56830* (F, LA in UC, US). **Cortés:** Vic. of La Lima, planted in hanging basket, *P. C. Standley & J. Chacón 7177* (F). **Francisco Morazán:** Río Guarabuquí, terranos de los indios Xicaques de la Montaña de La Flor, planta tendida, *A. Molina 3020* (F). MEXICO. **Quintana Roo:** en el poblado de Subteniente López, en casa habitación, *T. Pulido & L. Serralta 650* (MEXU); Cozumel Island, *G. F. Gaumer 109* (GH, NY); Cozumel Island, Caleta, *C. F. Millspaugh 1515* (F); Cozumel Island, San Miguel, *C. F. Millspaugh 1474* (F); Cozumel Island, rd. to Cedral, *C. F. Millspaugh 39* (F, GH). **Yucatán:** Izamal, *G. F. Gaumer 499* (F), *G. F. Gaumer s.n.* (F); Chichancanab, *G. F. Gaumer 1575* (F, GH, LA in UC, MO, US); Chikindzonot, house yard, *A. Ankli AANK044* (MEXU); en los alrededores de la zona arqueológica de Xlapac, a 27 km al SO de Oxkutzcab, *E. Cabrera & H. de Cabrera 9162* (MEXU, MO); Mun. Merida, en cultivo, *C. Vargas & P. Sima 350* (MEXU); near Merida, *P. Valdez 35* (BM, F, GH, MO, NY).

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Four New Species of Peruvian *Gentianella* (Gentianaceae)

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Abstract. Four new species of *Gentianella* Moench are described from Peru. *Gentianella iberidea* J. S. Pringle differs from *G. graminea* (Kunth) Fabris in its obtuse, non-arcuate leaves. *Gentianella sagasteguii* J. S. Pringle differs from similar species in its combination of linear-elliptic leaves, narrowly triangular calyx lobes, and lilac, widely campanulate to subrotate corollas with the lobes (1.1–)1.7–2× as long as the tube. *Gentianella smithii* J. S. Pringle differs from *G. paludicola* (Gilg) J. S. Pringle and *G. roseolilacina* (Gilg) J. S. Pringle in its perennial habit and blue corollas. *Gentianella uberula* J. S. Pringle differs from *G. sagasteguii* in its wider leaves and less deeply lobed corollas.

Resumen. Se describen cuatro nuevas especies de *Gentianella* Moench del Perú. *Gentianella iberidea* J. S. Pringle se diferencia de *G. graminea* (Kunth) Fabris por las hojas obtusas no arqueadas. *Gentianella sagasteguii* J. S. Pringle se diferencia de las especies de hábito parecido por las hojas lineares, las lóbulos del cáliz angustamente triangulares y las corolas lilacinas de lóbulos de largo (1.1–)1.7–2× que del tubo. *Gentianella smithii* J. S. Pringle se diferencia de *G. paludicola* (Gilg) J. S. Pringle y *G. roseolilacina* (Gilg) J. S. Pringle por el hábito perenne y las corolas azules. *Gentianella uberula* J. S. Pringle se diferencia de *G. sagasteguii* por las hojas más anchos y las corolas lobulados menos profundamente.

Key words: Gentianaceae, *Gentianella*, Peru.

The mountains of northern Peru are the habitat of a number of recently discovered species of *Gentianella* Moench (Gentianaceae), four of which are described here. The descriptions in this paper are based on specimens at HAM and MO; the replicates at other herbaria were not seen in this study.

1. Gentianella iberidea J. S. Pringle, sp. nov. TYPE: Peru. Piura: Prov. Huancabamba, Jalca (San Antonio-Talaneo), 3200 m, *A. Sagástegui A. & J. Cabanillas S. 8614* (holotype, HAM; isotypes, HUT not seen, MO). Figure 1.

Herba perennis caespitosa aspectu inter *Gentianellam gramineam* (Kunth) Fabris et *G. androsaceam* J. S. Pringle intermedia, sed a *G. graminea* caulibus distaliter foliis abruptius dissitis et foliis plerumque obtusis non arcuatis basi vaginantibus, a *G. androsacea* caulibus plus numerosis et floribus paucioribus minoribusque differens.

Clump- or patch-forming perennial with many somewhat woody, decumbent stems elongating through substrate, branching, older portions producing many adventitious roots; vegetative and flowering stems present simultaneously; portion of vegetative stems with green leaves of current season 1.5–6 cm, that of flowering stems 8–20 cm, simple. Leaves of vegetative stems and proximal 1.5–7 cm of flowering stems crowded; middle and upper cauline leaves of flowering stems in 3 to 5 pairs, separated by 1.5–5.5 cm; leaves nearly linear, slightly widened distally, 1-nerved, 10–25 × 1.2–2 mm; bases of proximal and midstem leaves connate-sheathing ca. 1 mm or less; apices mostly obtuse, those of uppermost leaves subacute. Flowers 3 to 7 in a reduced dichasium, usually 3 to 5 flowers in a terminal cluster, or 3 terminal flowers and 1 from each of a pair of axils less than 1 cm below; upper pedicels mostly 7–20 mm, lower to 40 mm, cyme thus being corymboid; occasionally 1 or 2 flowers at second node below summit on pedicels to 20 mm, or some abortive. Calyx 8–11 mm; calyx lobes lanceolate-triangular, 4.5–7 × 1.2–2 mm, acute; corolla funnelform-campanulate, 12–21 mm, white with veins toward base of lobes outlined in violet, glabrous within; lobes spatulate-obovate, 1.5–2× as long as tube, 1.5–2.5× as long as wide, rounded at apex.

Etymology. This new species is named for its resemblance to *Iberis saxatilis* L. and narrow-leaved forms of *I. sempervirens* L. in general aspect, although upon the arrival of a paratype the specific epithet coincidentally became a wordplay on the name of Gustavo Iberico Vela, a co-collector of *Sánchez V. et al. 10736*.

Discussion. In gross morphology, *Gentianella iberidea* is intermediate between *G. graminea* (Kunth) Fabris of Amazonas and Cajamarca departments, Peru, and *G. androsacea* J. S. Pringle of southern Ecuador. It differs from *G. graminea* in its more abrupt transition from closely spaced near-basal leaves to widely separated middle and distal cauline leaves, scarcely to not at all arcuate leaves, connate-sheathing bases of the proximal leaves, and obtuse to subacute rather than acute to acuminate leaf apices. It

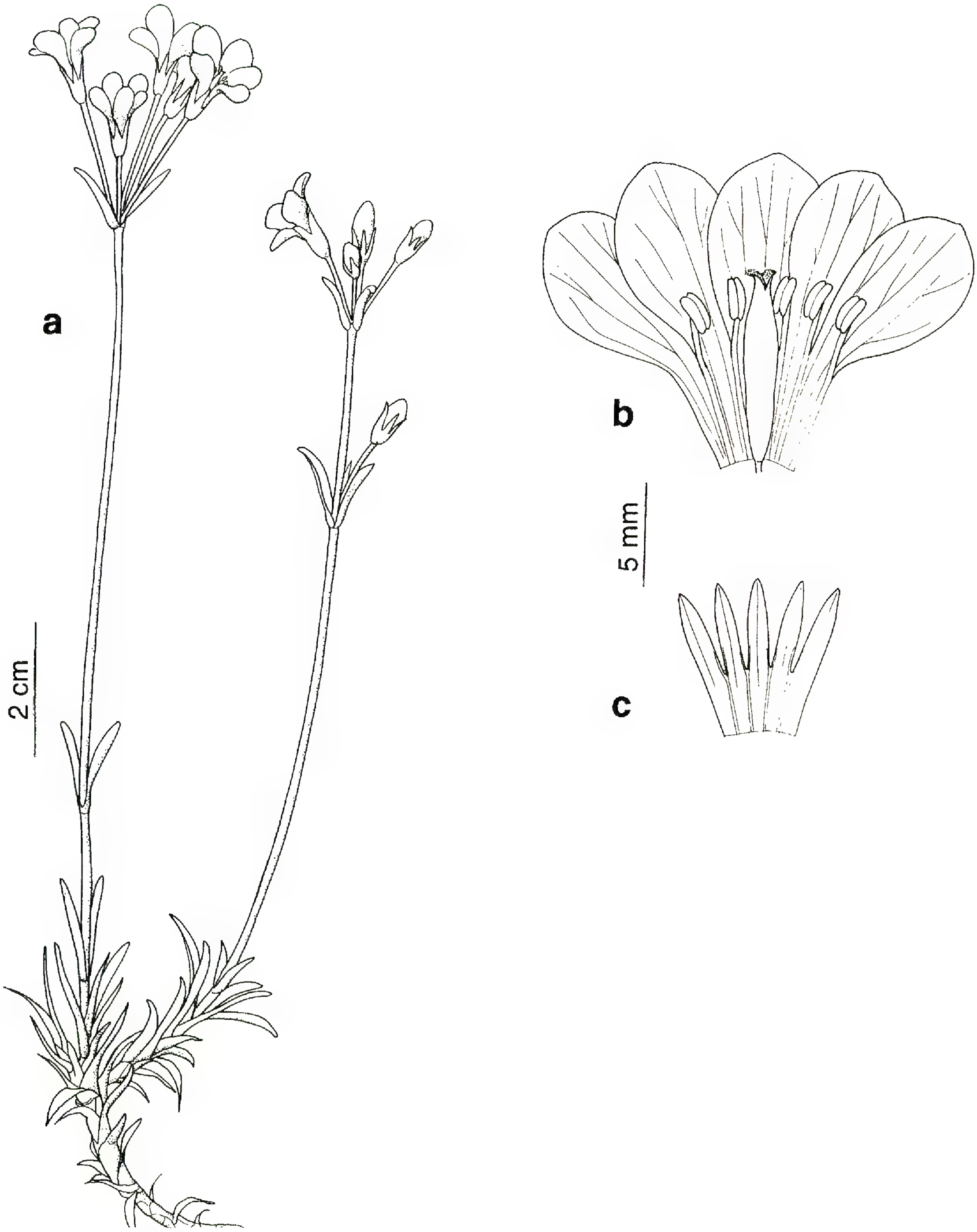

Figure 1. *Gentianella iberidea* J. S. Pringle. —a. Habit. —b. Corolla, stamens, and pistil. —c. Calyx. Drawn from the type, *Sagástegui & Cabanillas 8614* (HAM).

differs from *G. androsacea* in its greater number of stems per plant, forming loose clumps or small patches; narrower, 1-nerved leaves; proximal cauline leaves that are not strictly crowded into basal rosettes; and stems in the vegetative stage that elongate to several centimeters rather than remaining as rosettes. The maximum number of flowers per inflorescence is much fewer than in *G. androsacea*. These features also distinguish it from *G. corymbosa* (Kunth) Weaver & Rüdenberg of Colombia. It differs from *G. oreosilene* (Gilg) J. S. Pringle, of Amazonas Department, in the same respects as from *G. graminea* and also in its

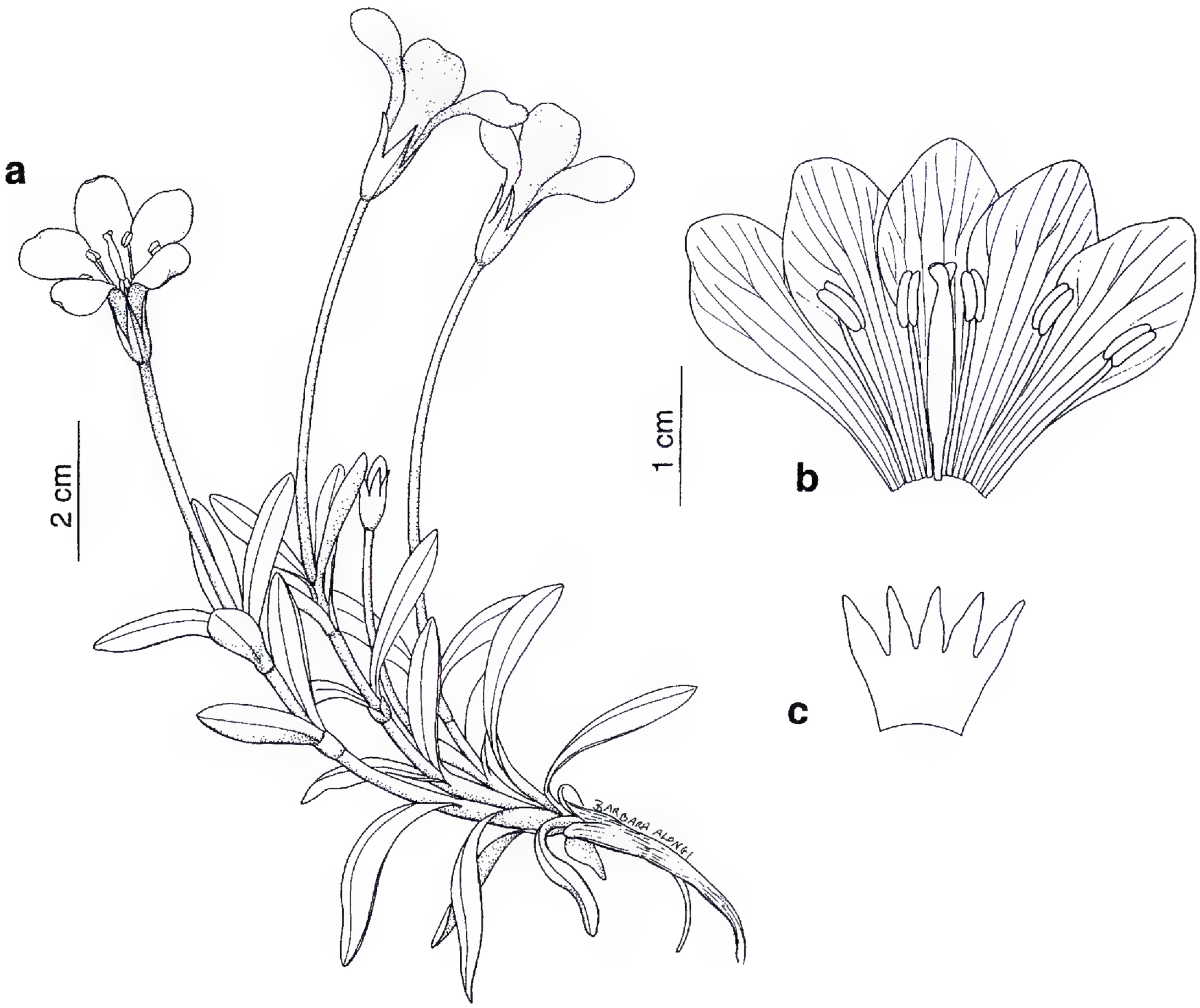

Figure 2. *Gentianella sagasteguii* J. S. Pringle. —a. Habit. —b. Corolla, stamens, and pistil. —c. Calyx. Drawn from the type, *Sagástegui et al. 14000* (HAM).

corymboid or umbelloid rather than more elongate, racemoid inflorescences.

Paratypes. PERU. **Cajamarca:** Prov. Hualguyoc, 5 km de la carretera a Yanacanchilla Alta, desvio de la carretera a Hualgayoc (Area Las Lagunas), 6°52′S, 78°35′W, 3950 m, *I. Sánchez V. G. Iberico & J. Salcedo A. 10736* (CPUN, F, HAM).

2. Gentianella sagasteguii J. S. Pringle, sp. nov. TYPE: Peru. Cajamarca: Prov. Contumazá, pozo Kuán, 3790 m, *A. Sagástegui A., R. Ramírez, E. García & S. Leiva 14000* (holotype, HAM; isotypes, F not seen, HUT not seen). Figure 2.

Herba perennis caespitosa foliis dense aggregatis et floribus solitariis, a speciebus similibus in Peruvia septentrionali foliis lineari-ellipticis, calycibus nervis prominentibus et lobulis anguste triangularibus vel oblongo-triangularibus et corollis lilacinis late infundibuliformi-campanulatis usque subrotatis lobulis quam tubo (1.1–)1.7–2plo longioribus distinguenda.

Caespitose perennial; vegetative stems to 4 cm present along with flowering stems; flowering stems ± decumbent, simple, 1–4 cm long exclusive of peduncle. Leaves all closely spaced on vegetative stems, usually 1 or 2 pairs above those crowded near base on flowering stems. Leaves linear-elliptic, 1- or obscurely 3- or 5-nerved, 10–18 × 1–2 mm; lower leaves subacute, upper acute; bases connate-sheathing 2–4 mm or uppermost pair with shorter sheaths; leaf margins smooth. Flowers solitary, erect; peduncles 2–5 cm, purplish distally. Calyx 8–11 mm, midveins and commissural veins raised, outlined with purple suffusion; lobes narrowly triangular or oblong-triangular, 4–5.5 × 1.8–2.2 mm, acuminate; corolla widely funnelform-campanulate to subrotate, 16–24 mm, pale to medium violet, darker on exterior toward outer edge of lobes; inner surface with a few trichomes 0.3–0.8 mm long above stamens, especially near sinuses; lobes spatulate-obovate, (1.1–)1.7–2× as long as tube, (1.4–)1.8–2.2× as long as wide, rounded at apex.

Etymology. This species is named for its discoverer, Abundio Sagástegui Alva, in recognition of his

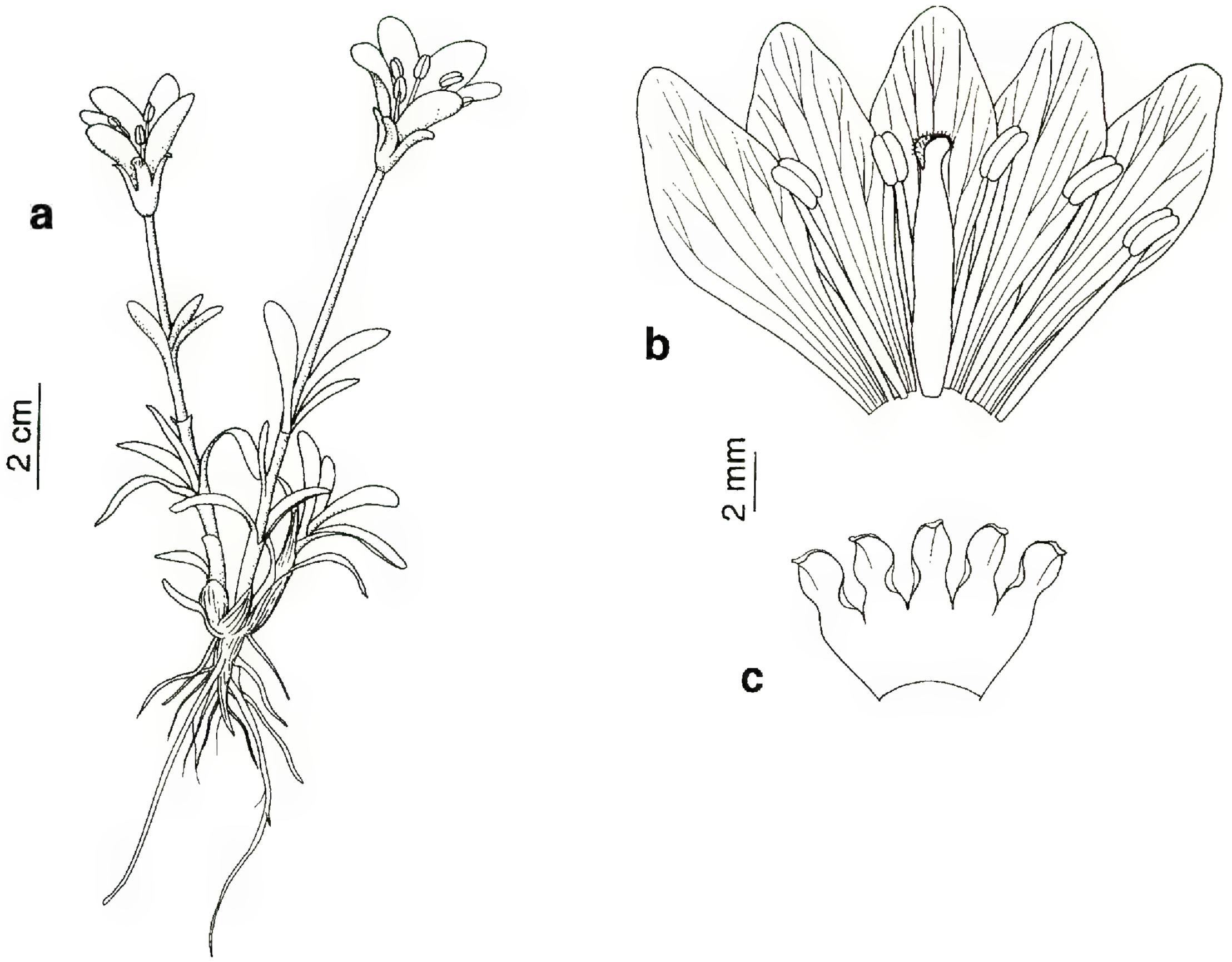

Figure 3. *Gentianella smithii* J. S. Pringle. —a. Habit. —b. Corolla, stamens, and pistil. —c. Calyx. Drawn from the type, *Smith & Torres 11774* (HAM).

contributions to the knowledge of the flora of northern Peru.

Discussion. The combination of narrow, nearly linear leaves and deeply lobed, violet corollas with widely spreading lobes distinguishes *Gentianella sagasteguii* from other solitary-flowered *Gentianella* species in northern Peru. The ridged calyx tube and lobes also contribute to its distinctness.

Paratypes. PERU. **Cajamarca:** Prov. Contumazá, alrededores del pozo Kuán, 3600–3800 m, *A. Sagástegui A., E. García, S. López & J. Mostacero 10079* (HAM, HUT not seen, MO); Prov. Contumazá, jalca del pozo Kuán, 4000 m, *A. Sagástegui A., E. Alvítez & J. Mostacero 10785* (HAM, HUT not seen, MO); Prov. Cajabamba, Llamacorral (ruta a Luchubamba), 7°33.8′S, 78°01.3′W, 3750 m, 4 Aug. 2002, *A. Sagástegui A., M. Zapata & J. Leal 16960* (F, HAM, HAO). **La Libertad:** Prov. Otuzco, arriba de la escuela de Purrupampa, 3490 m, *S. Leiva & P. Leiva 336* (F, HAM).

3. Gentianella smithii J. S. Pringle, sp. nov. TYPE: Peru. Ancash: Prov. Recuay, Huascarán Natl. Park, Río Pachacoto drainage at mineral springs near Carpa (77°7′W, 9°53′S), 4200 m, *D. N. Smith & M. Torres 11774* (holotype, HAM; isotype, MO). Figure 3.

Herba caespitosa *Gentianellae paludicolae* (Gilg) J. S. Pringle et *G. roseolilacinae* (Gilg) J. S. Pringle similis, sed ab eis habitu perenni et foliis apice obtusis, lobulis calycis oblongis vel interdum oblongo-oblanceolatis abrupte acutis et corollis lilacinis, etiam a *G. paludicola* plantis minoribus et a *G. roseolilacina* corollis profundius lobatis differens.

Caespitose perennial; older stems covered with remains of leaves of previous season; vegetative rosettes present along with flowering stems, the latter decumbent, currently leafy portion to 1.5 cm long below peduncle. Leaves of flowering stems in 1 to 3 pairs, crowded or separated by internodes less than 1 cm long. Leaves narrowly oblanceolate to narrowly obovate, to 7-nerved but with only 1 or 3 nerves prominent, 6–18 × 1.5–3.5 mm, bases connate-sheathing 2.5–4 mm, sheaths often overlapping, apices obtuse; leaf margins smooth, not thickened. Flowers solitary; peduncle 15–30 mm, ± suffused with purple. Calyx 6.5–8 mm; calyx lobes oblong or occasionally oblong-oblanceolate to narrowly ovate, 3.5–5 × 1.5–2 mm, abruptly acute, often carinate-

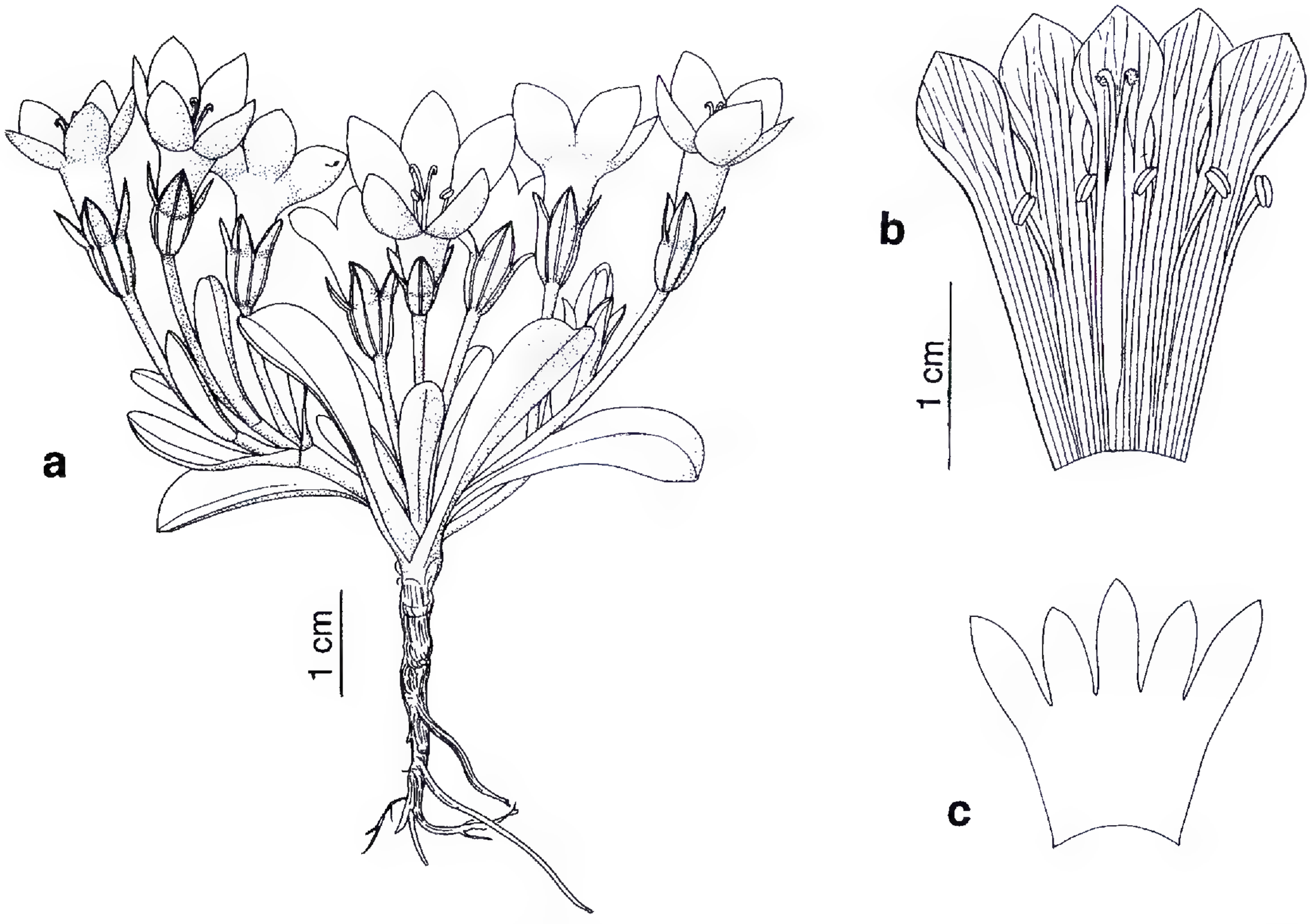

Figure 4. *Gentianella uberula* J. S. Pringle. —a. Habit. —b. Corolla, stamens, and pistil. —c. Calyx. Drawn from the type, *Sagástegui et al. 12043* (HAM).

conduplicate and recurved toward apex, margins smooth; corolla widely funnelform-campanulate, 13–16 mm, light violet-blue with yellowish green base, glabrous within; lobes elliptic-rhombic, 2.2–3× as long as tube, 2–2.4× as long as wide, subacute; anthers purple.

Etymology. This species is named in memory of its discoverer, David Nelson Smith (1945–1991), in recognition of his contributions to the floristic knowledge of Peru and Bolivia.

Discussion. *Gentianella smithii* is similar to *G. paludicola*, which also occurs in Ancash Department, Peru, but it does not seem possible to interpret it as constituting very small plants of that species. *Gentianella smithii* is obviously a caespitose perennial, whereas *G. paludicola* is evidently monocarpic; the leaves of *G. smithii* are rounded to obtuse at the apex, whereas those of *G. paludicola* are acute; the calyx lobes are of different shapes, those of *G. smithii* being oblong and abruptly acute, and those of *G. paludicola* being lanceolate and acuminate; and the corollas of *G. smithii* were described by Smith (in sched., type) as "purplish blue, yellowish green at base," whereas those of *G. paludicola* were described by Weberbauer (in Gilg, 1906: 42, translated) as "white, externally violet-nerved" above the yellowish throat. The type of *G. smithii* was found in "boggy ground in bottom, soil very wet or saturated" (in sched.), so the lower stature and generally different aspect of these specimens cannot be attributed to a drier habitat than that of the type of *G. paludicola*.

Gentianella roseolilacina is another solitary-flowered species in Ancash Department, which was frequently encountered by Smith and his associates in Huascarán National Park. It differs from *G. smithii* in its apparently monocarpic habit; narrower, acuminate calyx lobes; light magenta or pinkish violet rather than violet-blue corollas; and corolla lobes scarcely longer than the tube. *Gentianella cerrateae* Fabris, also of Ancash Department, differs in its much smaller flowers with the corolla lobes distinctly shorter than the tube.

4. Gentianella uberula J. S. Pringle, sp. nov. TYPE: Peru. Cajamarca: Prov. Celendín, La Encañada, 3350 m, *A. Sagástegui A., J. Mostacero & S. Leiva 12043* (holotype, HAM; isotypes, HUT not seen, MO). Figure 4.

Herba perennis caespitosa a *Gentianella sagasteguii* J. S. Pringle foliis latioribus et corollis minus profunde lobatis distinguenda.

Caespitose perennial; tap root and caudex stout (4–8 mm diam. near summit), caudex covered with

remains of old leaf bases; stems many, decumbent, to 3.5 cm exclusive of terminal peduncle; rosettes and/or vegetative stems to 3 cm present along with flowering stem; stems mostly simple, with basal leaves only; longest stems with 1 to 3 pairs of cauline leaves, these sometimes in false whorls (one pair immediately above another), sometimes with paired branches each with 1 pair of leaves; flowering stems ± decumbent, simple, 0.5–3.5 cm long exclusive of peduncle. Leaves 3- to 7-nerved but usually only midrib prominent, 9–20 × 2–5 mm; rosette, basal, and lower cauline leaves linear-oblanceolate or with a ± petiolar base gradually expanding into a spatulate to elliptic-oblanceolate, distal portion, bases connate-sheathing to 4 mm, apices obtuse to subacute; transitional to oblanceolate distal leaves (if present) without petiolar base, bases scarcely or not sheathing, apices acute; pale leaf margins ca. 0.05–0.1 mm wide, sharply differentiated, smooth or minutely undulate. Flowers solitary; peduncles 4–70 mm, purple-tinged. Calyx 7–18 mm, ± suffused with purple, midveins and commissural veins raised; calyx lobes oblong-lanceolate to narrowly triangular, 3–12 mm long, 1–3.5 mm wide at base, varying in width on same calyx, obtuse to acute, margins smooth or minutely undulate; corolla funnelform-campanulate, 14–35 mm, lilac to purple (see notes below), pale yellow toward base, glabrous within; corolla lobes spatulate-elliptic to spatulate-obovate, (0.6–)0.8–1.2× as long as tube, 1.5–2× as long as wide, obtuse to abruptly acute; anthers pale yellow.

Etymology. The specific epithet is derived from the Latin word meaning "fruitful," with a diminutive suffix, referring to the abundance of proportionately large, showy flowers produced by small plants.

Discussion. *Gentianella uberula* is similar to *G. sagasteguii*, but differs in its obtuse to acute rather than acuminate calyx lobes and in its much less deeply divided corolla blotched at the throat. From *G. smithii* it differs in its less deeply lobed corolla with proportionately wider lobes.

From the appearance of the herbarium specimens, the corollas of the holotype and those of the paratype *Sagástegui A. & Zapata C. 16472*, in both cases described by Sagástegui (in sched.) as "moradas," appear to have been rather deep purple. The predominant corolla color of some of the paratypes, described (in sched.) as "lilas" or "liladas," appears to have been paler, and that of another paratype, described as "violáceas," appears to have been similar or slightly darker. In some specimens, the corollas appear especially boldly patterned. Above the yellow base are five deeply colored blotches, above which a pale zone is transitional to the lilac or violet of the greater part of the lobes. Similar corolla blotches occur in the Bolivian *Gentianella bockii* (Gilg) T. N. Ho & S. W. Liu and *G. neomandonii* (R. C. Foster) T. N. Ho & S. W. Liu, but *G. uberula* differs from these geographically distant species in its less deeply lobed calyx and corolla and from *G. neomandonii*, especially, in its narrower leaves.

Paratypes. PERU. **Cajamarca:** Prov. Cajamarca, Jalca Kumulca (Km 54 ruta Cajamarca–Celendín), 3700 m, *A. Sagástegui A., J. Luteyn & D. S. Sylva 15779* (HAM, HAO, NY). **La Libertad:** Prov. Sánchez Carrión, señal Huaylillas, 78°02′W, 7°53′S, 4300 m, *D. N. Smith 2254* (HAM, MO); Prov. Sánchez Carrión, alrededores de laguna Cushuro (pie del Nevado Huaylillas), 7°54′S, 78°00′W, jalca, 4078 m, *A. Sagástegui A. & M. E. Zapata C. 16472* (F, HAM, HAO); Prov. Santiago de Chuco, Jalca de Quesquenda, 7°55.3′S, 78°10.2′W, 3960 m, *A. Sagástegui A. & M. E. Zapata C. 16578* (F, HAM, HAO); Prov. Pataz, Alto Togana, Tayabamba–Huancaspata, 4000 m, *A. López M. & A. Sagástegui A. 8199* (HAM, HUT not seen, MO); Prov. Santiago de Chuco, Pampas de la Julia, 7°55.5′S, 78°18′W, 4060 m, *A. Sagástegui A., M. Zapata & J. Leal 16942* (F, HAM, HAO); Prov. Pataz, Laguna Cujibamba (Huaylillas), 8°09.6′S, 77°18.7′W, 3900 m, *A. Sagástegui A. & M. Zapata 17018* (F, HAM, HAO).

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A New Species of *Nama* (Hydrophyllaceae) in Guatemala

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ABSTRACT. The preparation of the taxonomic treatment of *Nama* L. (Hydrophyllaceae) for the *Flora Mesoamericana* resulted in the discovery of a new species from Guatemala. *Nama segetale* Ricketson is described and illustrated.

RESUMEN. El estudio preparatorio para llevar a cabo un tratamiento taxonómico del género *Nama* L. (Hydrophyllaceae) para la *Flora Mesoamericana* resultó en el descubrimiento de una especie nueva para la ciencia, *Nama segetale* Ricketson, proveniente de Guatemala, que se describe e ilustre.

Key words: Guatemala, Hydrophyllaceae, IUCN Red List, *Nama*.

The genus *Nama* L. contains approximately 60 species, primarily from the southwestern United States and northern Mexico, less common in Florida, the Caribbean, and Mesoamerica south to Argentina and Chile, and with an endemic species in Hawaii. The genus is typically defined as: herbaceous to suffrutescent, annuals or perennials from slender taproots, usually 10–50 cm tall, erect to prostrate, simple or branched, pubescent, often glandular, unarmed; the leaves mostly alternate and entire; the inflorescences with flowers borne singly or in pairs in axils of upper leaves or several in reduced lateral or terminal cymes; the flowers with calyx divided nearly to base; the corolla white to purple, tubular to funnelform or obconic-campanulate, exceeding the calyx; the stamens usually included, adnate and unequal; the ovary superior to semi-inferior, unilocular; the ovules many; the styles two, usually free, rarely variously united; the fruit a capsule; the seeds numerous, variously pitted.

While preparing the taxonomic treatment of *Nama* for inclusion in the Hydrophyllaceae for the *Flora Mesoamericana*, a new species from the Department of Huehuetenango, Guatemala, was discovered and is described herewith. Formal conservation assessment is reported.

Nama segetale Ricketson, sp. nov. TYPE. Guatemala. Huehuetenango: deep canyon of a tributary of Río Blanco, ca. 5 km W of Aguacatán, in cornfield, 4 Dec. 1962 (fl., fr.), *L. O. Williams, A. Molina R. & T. P. Williams 22352* (holotype, F). Figure 1.

Haec species quoad trichomata unicellularia ad bases globosa, erecta, hirsuta vel hispida, brevia et longiora intermixta *Namati pueblensi* B. L. Robinson & Greenman arcte similis, sed ab eo laminis foliaribus minoribus 4.9–14.2 × 1.2–3.5 (non 8–19.5 × 3.5–7.2) cm, lobulis calycinis (3.5–)4–5.2 (non 5.5–8.1) mm longis denique capsulis 2.8–2.9 (non 3.2–4.5) mm longis praeclare distat.

Annuals, erect to ascending terete stems, 8–25 cm, stems, leaves, and calyx with mixture of short and long stiff, erect hirsute to hispid simple unicellular trichomes with globular bases. *Leaves* alternate, chartaceous, oblanceolate, 4.9–14.2 × 1.2–3.5 mm, apically obtuse to broadly acute, basally decurrent, long straight to slightly appressed hirsute to hispid trichomes, the midrib impressed adaxially, prominently raised abaxially, the secondary veins indistinct, the margins entire; epetiolate. *Inflorescences* 2- to 3-flowered terminal and lateral cymes, with mixture of short and long stiff, erect hirsute to hispid simple unicellular trichomes with globular bases; peduncles terete, filiform, 0.9–3.9 cm; bracts similar to the leaves; pedicels terete, filiform, 0.3–0.7 mm. *Flowers* 5-merous; calyx chartaceous, (3.5–)4–5.2 mm, the tube 0.5–0.8 mm, hyaline between the lobes, the lobes linear to linear-lanceolate, (3–)3.5–4.4 × 0.4–0.5 mm, apically acute to narrowly rounded, with a mixture of scattered to dense short and long stiff, erect hirsute to hispid simple unicellular trichomes with globular bases, the midrib obscure above and prominently raised below, the margins entire; corolla white, purplish tint when dry, salverform, 3.9–4.2 mm, the tube 3.2–3.4 × 0.8–1 mm, the lobes ovate to oval, 0.5–1 × 0.6–1 mm, apically rounded, few to scattered short stiff erect hirsute to hispid simple unicellar trichomes with globular bases, margins entire to slightly erose; stamens included, unequally inserted at 2 or 3 levels, 2.5–3 mm, filaments 2.2–2.7 mm, fused 1.1–1.6 mm, free portion 0.9–1.1 mm; anthers ovate, 0.3–0.5 mm diam., basifixed; pistil 3.9–4.2 mm, ovary 0.3–0.4 × 0.1–0.2 mm, hirsute, styles 2, 0.8–1.3 mm. *Fruits* capsules, 2.8–2.9 × 1.6–2 mm, thin walled, scattered hirsute, seeds brown, 19 to 25, 0.7–0.9 × 0.4–

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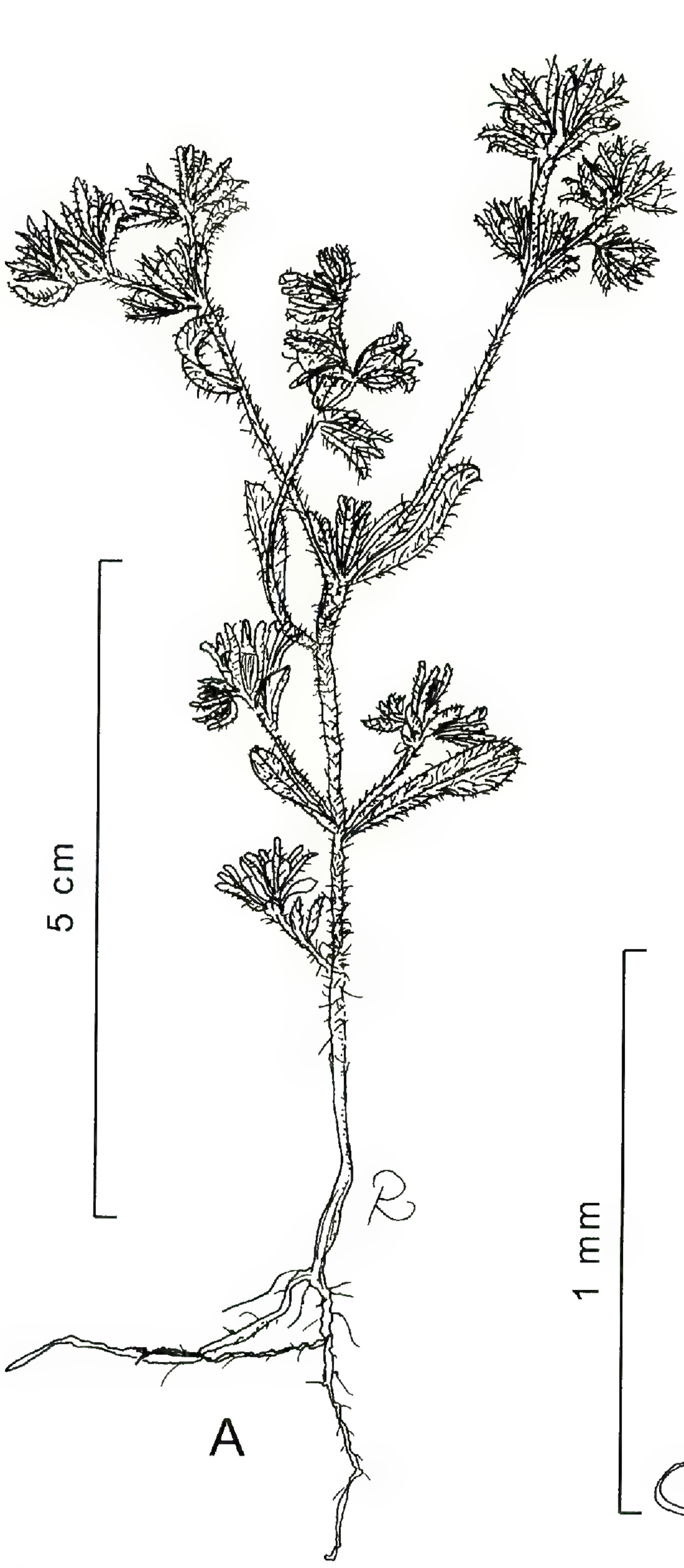

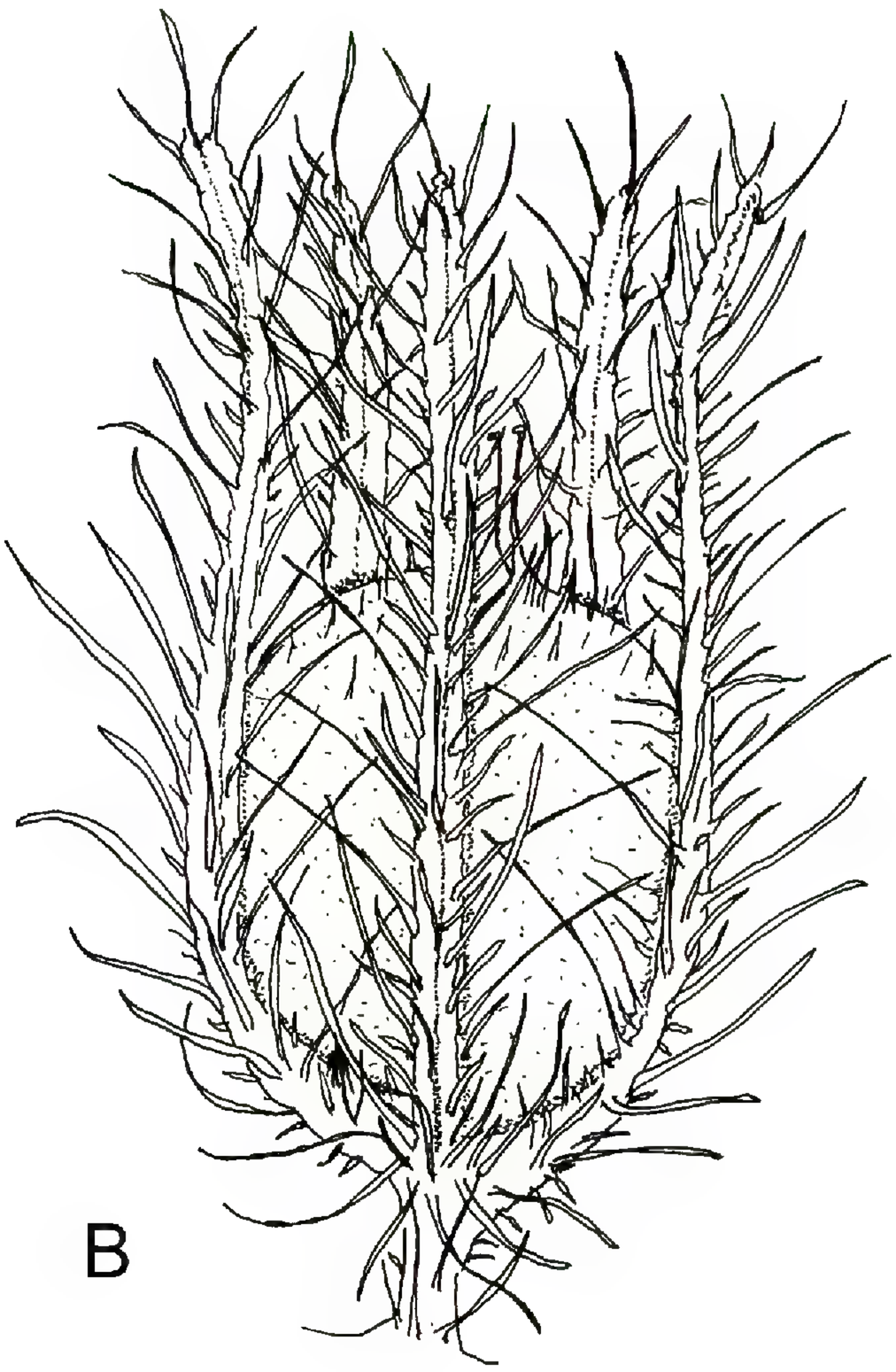

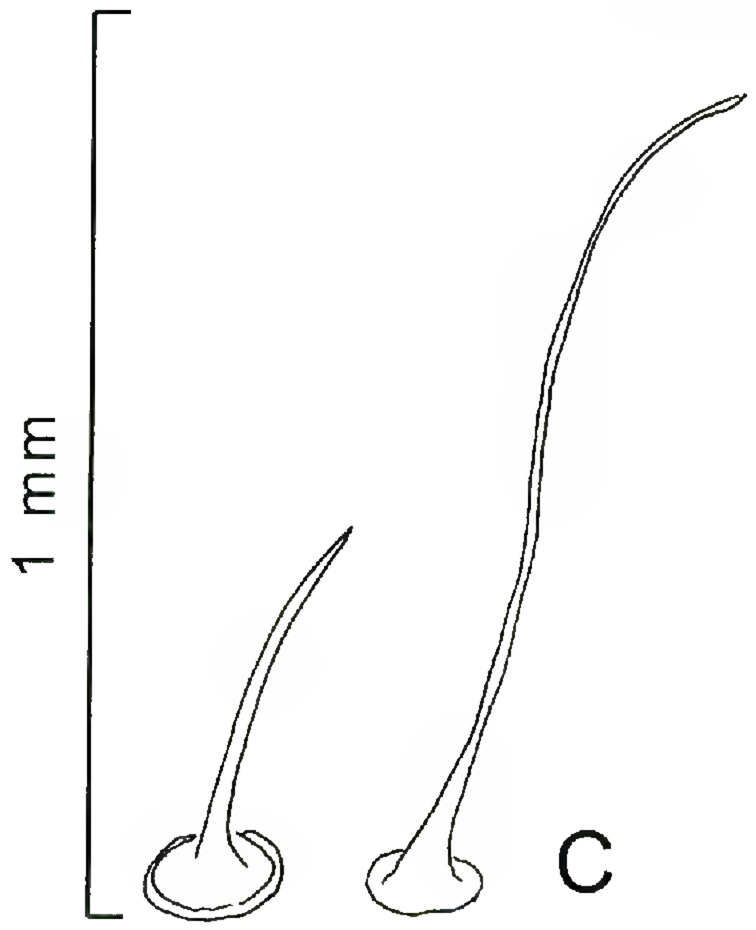

Figure 1. *Nama segetale* Ricketson. —A. Plant. —B. Detail of flower in young fruit. —C. Typical short and long stiff, erect hirsute to hispid simple unicellular trichomes with globular bases. Drawn from the holotype, *L. O. Williams, A. Molina R. & T. P. Williams 22352* (F).

0.5 mm, outer surface chambered with undulate chamber walls.

Distribution. *Nama segetale* is an annual, only known from a single collection, west of Aguacatán, in the department of Huehuetenango, Guatemala.

Ecology and IUCN Red List category. *Nama segetale* was collected in a cornfield over 40 years ago and has not been re-collected since. Further fieldwork will be necessary to locate any existing individuals or populations and to determine whether or not this species is in fact extinct. Until further assessment can be made, according to IUCN Red List criteria (IUCN, 2001), this species would be Critically Endangered (CR B2a; D) owing to (B) area of occupancy estimated at less than 10 km^2 and (2a) known only from one collection, so (D) the total population size is estimated at less than 50 mature individuals.

Etymology. The specific epithet comes from the Latin "segetale": "belonging to *or* growing among standing corn" (Stearn, 1995: 491).

Discussion. In Gibson's (1970) treatment of the Hydrophyllaceae for the *Flora of Guatemala*, she determined the collection that is now the type of *Nama segetale* Ricketson as *N. dichotomum* var. *pueblense* (B. L. Robinson & Greenman) J. F. Macbride [= *N. pueblense* B. L. Robinson & Greenman]. Her inclusion of *N. dichotomum* var. *pueblense* is based solely on the *L. O. Williams, A. Molina R. & T. P. Williams 22352* collection. While comparing the type collections, it was determined that *N. pueblense* is significantly different from *N. dichotomum* to warrant its re-elevation to species status.

Nama segetale (a Guatemala endemic) and *N. pueblense* (a species from central and northern Mexico) have a similar mixture of short and long stiff, erect hirsute to hispid simple unicellular trichomes with globular bases and have seeds with similar seed walls. However, *N. segetale* differs from the material associated with the type of *N. pueblense* by its smaller leaves 4.9–14.2 × 1.2–3.5 (not 8–19.5 × 3.5–7.2) cm, shorter calyx lobes (3.5–)4–5.2 (not 5.5–8.1) mm long, and smaller capsules 2.8–2.9 (not 3.2–4.5) mm long.

According to Hitchcock's (1933) treatment, *Nama segetale* would be a member of *Nama* sect. *Eunama* C. L. Hitchcock, the largest of his sections, based on its entire leaves, superior ovary, the styles not united over half their length, and the capsule membranous and loculicidally dehiscent. The seeds of *N. segetale* are chambered with undulate chamber walls, placing them in Seed Group 6 as delimited by Chance and Bacon (1984). Seed Group 6 contains three Mesoamerican species, *N. sericeum* Willdenow ex Roemer & Schultes, a perennial species; *N. dichotomum* (Ruiz & Pavón) Choisy, an annual species with a mixture of hirsute to hispid and glandular trichomes; and *N. segetale*, an annual species with hirsute to hispid trichomes and no glandular trichomes.

Four species of *Nama* are now known in Guatemala. *Nama jamaicense* L. is a common widespread prostrate annual with variable leaves rotund or broadly ovate to spatulate or broadly obovate-spatulate, the blades decurrent on the petioles forming a broad wing. *Nama hirsutum* M. Martens & Galeotti is a locally common ascending perennial with leaves ovate, oblong-ovate, or elliptic-lanceolate, strigose to hirsute, petioles not winged. *Nama dichotomum* is a widespread common erect or ascending annual with leaves linear-elliptic, linear-oblanceolate, or narrowly spatulate but with a mixture of hirsute to hispid and glandular trichomes throughout, petioles not winged. *Nama segetale*, as described above, is an endemic (only known from a single collection) erect or ascending annual with leaves oblanceolate with a mixture of short and long stiff, erect hirsute to hispid simple unicellular trichomes with globular bases, petioles not winged.

It is interesting to note that L. O. Williams, A. Molina R., and T. P. Williams made a number of collections on 4 Dec. 1962, and of these at least three, *22351* (F), *22352* (F), and *22356* (F, G, TEX-LL), are of *Nama*, apparently from the same cornfield as the type of *N. segetale*. All three collections visually appear different; however, with their mixture of hirsute to hispid and glandular trichomes throughout, the *22351* and *22356* specimens are clearly collections of *N. dichotomum*.

Acknowledgments. I thank Gerrit Davidse and the Flora Mesoamericana Project at the Missouri Botanical Garden for their support. Special thanks to John J. Pipoly III for his comments on the paper and for preparing the resumen and Latin diagnosis. The author prepared the drawing.

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Paneroa, a New Genus of Eupatorieae (Asteraceae) from Mexico

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Abstract. The new genus *Paneroa* E. E. Schilling (Asteraceae, Eupatorieae) from the Mixteca Alta region in the state of Oaxaca, Mexico, is described and illustrated, and a new combination, *P. stachyofolia* (B. L. Robinson) E. E. Schilling, is made. The genus is characterized by its alternate, sessile leaves, 4-ribbed phyllaries, short coroniform pappus, and clavate style appendages. Molecular phylogenetic analyses show that the genus is distinct from *Ageratum* L., in which the species was originally described, and is closely related to other genera including *Conoclinium* DC. and *Fleischmannia* Schultz Bipontinus. It occurs in a floristic region that is characterized by numerous endemics.

Key words: *Ageratum*, Asteraceae, Eupatorieae, IUCN Red List, Mexico, Mixteca Alta, *Paneroa*.

A survey of molecular variation for the ITS and ETS spacer regions revealed that *Ageratum stachyofolium* B. L. Robinson was not only distinct but was placed relatively distant from the rest of the sampled species of *Ageratum* L. (E. E. Schilling, J. L. Panero & B. Crozier, unpublished data). The survey of *Ageratum* was conducted to obtain outgroup data for a comprehensive analysis of *Conoclinium* DC., and the result prompted a more detailed investigation of the placement of *A. stachyofolium* using a broader array of chloroplast DNA sequences. The results of the molecular phylogenetic studies confirmed the distinctiveness of *A. stachyofolium*, which had already been noted from morphological analyses. Based on these results, a new Mexican genus *Paneroa* E. E. Schilling is described herein.

Paneroa E. E. Schilling, gen. nov. Basionym: *Ageratum* sect. *Stachyofolium* M. F. Johnson, Ann. Missouri Bot. Gard. 58: 79. 1971. TYPE: *Paneroa stachyofolia* (B. L. Robinson) E. E. Schilling.

Genus novum *Agerato* L. affine quoad pappum coroniformem, a quo foliis alternis, phyllariis 4-costatis, et stylis conspicue clavatis differt.

Paneroa stachyofolia (B. L. Robinson) E. E. Schilling, comb. nov. Basionym: *Ageratum stachyofolium* B. L. Robinson, Proc. Amer. Acad. Arts 36: 476. 1901. TYPE: Mexico. Oaxaca: vic. of La Parada, 19 Aug. 1894, *E. W. Nelson 991* (holotype, GH; isotypes, F not seen, K not seen, US). Figure 1.

Perennial herbs, 30–88 cm tall, stems terete, striate, reddish green, sericeous, trichome density increasing distally, trichomes on stem and other vegetative parts simple, multicellular, somewhat sinuous, 0.2–1 mm. Leaves alternate throughout or sometimes opposite proximally and alternate distally, sessile or nearly so, blades 30–50 × 11–25 mm, smaller distally, elliptic, base obtuse to cuneate, apex widely acute to rounded, margin somewhat revolute, crenate, adaxial surfaces green, sericeous; abaxial surfaces pale green, densely white sericeous, subsessile-glandular trichomes numerous and scattered throughout the surface. Capitulescences terminal, of 7 to 17 heads in a compact to somewhat open corymbose cluster; peduncles 1–75 mm, densely sericeous, bracteolate; heads discoid, hemispheric, erect, 8–11 × 8–10 mm; receptacle epaleate. Phyllaries 30 to 35 in 2 closely overlapping series, 5–6.5 × 0.5–0.7 mm, linear to somewhat spatulate, 4-ribbed, apex acute, surface white pilose, with scattered subsessile glandular trichomes; flowers ca. 100 per head, corollas funnelform, creamy white, 3.2–3.5 mm, tubes ca. 1.5 mm, sparsely pilose with scattered subsessile glands; throats ca. 1.5 × 0.5 mm at proximal end broadening to ca. 1 mm wide at distal end, lobes 0.5–0.7 mm, papillose on inner surfaces; anthers ca. 0.7 mm, whitish, anther appendages ca. 0.1 mm, rounded, about as wide as long; styles ca. 11 mm, creamy white, glabrous, the branches ca. 5 mm, papillose, conspicuously clavate. Cypselae black, 2.2–3 mm, prismatic, tapering to base, with 5 ribs, glabrous, carpopodium not strongly differentiated; pappus coroniform, whitish tan, 0.3–0.5 mm, margin entire to obscurely dentate.

Distribution, habitat, and IUCN Red List category. *Paneroa stachyofolia* is a rare species that occurs in open pine-oak woodlands in the Mixteca Alta region in the state of Oaxaca, Mexico. This area harbors numerous endemics, including one endemic genus (*Ainea* Ravenna), several near endemic genera (*Fosteria* Molseed, *Gibasoides* D. R. Hunt, and

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Figure 1. *Paneroa stachyofolia* (B. L. Robinson) E. E. Schilling. —A. Habit. —B. Leaf with detail of margin. —C. Head. —D. Phyllary, abaxial and lateral views. —E. Corolla. —F. Detail of corolla and androecium. —G. Cypsela. Drawn from *Panero & Calzada 5894* (TEX).

Pseudocranichis Garay), and numerous endemic species (García-Mendoza et al., 1994). The area is characterized by a diversity of relatively mesic highland habitats that are surrounded by xerophytic areas, conditions that have apparently encouraged the development of distinctive taxa, particularly in the herbaceous perennials that make up over half of the species there (García-Mendoza et al., 1994). Endemics

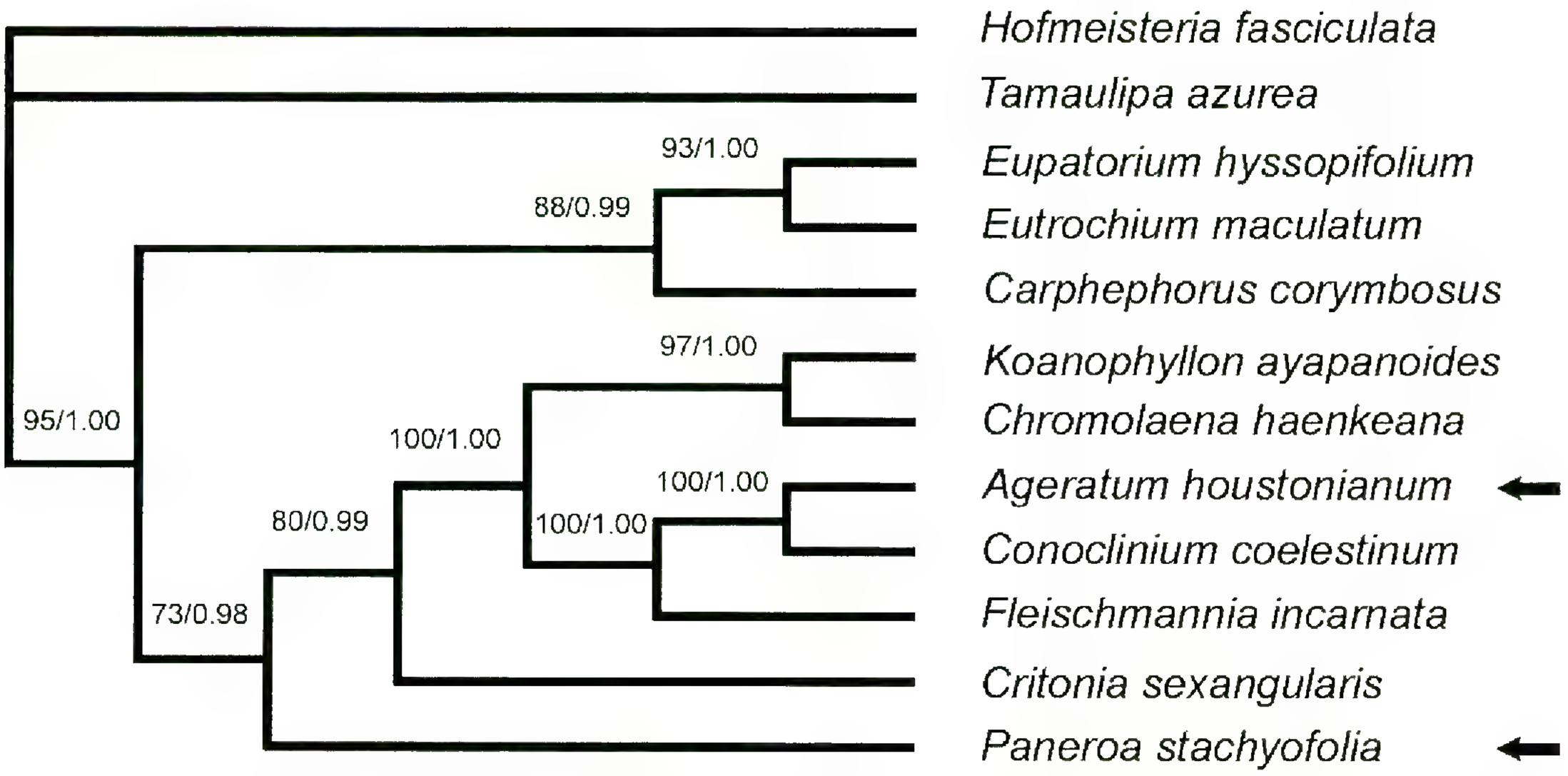

Figure 2. Single most parsimonious tree (length = 346 steps; consistency index [CI] = 0.91; retention index [RI] = 0.78) from analysis of chloroplast DNA data (total of 4200 aligned base pairs) for *Paneroa* and related genera, with bootstrap support (1000 replicates)/Bayesian posterior probabilities shown above branches, showing the placement of *Paneroa* relatively distant from *Ageratum* (arrows). Voucher data for chloroplast DNA sequence data used to prepare the tree are provided in Appendix 1.

continue to be described (e.g., Panero & Villaseñor, 1996, 1997, 1998) as the area receives additional botanical attention. Prior to the relatively recent collections of the new genus listed as paratypes below, *P. stachyofolia* was known only from the type collection, and it must be viewed as a relatively uncommon species. Based on its restriction to an area entirely within the state of Oaxaca, its somewhat sporadic occurrence, and its relatively small population sizes, *P. stachyofolia* should be classified as Near Threatened (NT) according to IUCN Red List criteria (IUCN, 2001).

Etymology. The genus is named in honor of José L. Panero (University of Texas at Austin, b. 1959), who has made numerous contributions to the knowledge of Asteraceae systematics and of the Mexican flora through his indefatigable fieldwork, expert eye, and passionate pursuit of botanical science.

Relationships. Paneroa stachyofolia was recognized as distinctive relative to other species of *Ageratum* by Johnson (1971), who erected a monospecific section for it. King and Robinson (1987) also noted its morphological distinctiveness and retained it in section *Stachyofolium* M. F. Johnson. Results of molecular phylogenetic analyses (Schilling, unpublished data) based on the chloroplast gene coding regions *ndhF* and *matK* and the *trnH-psbA* spacer placed it in a basally diverging position relative to a number of other Mexican genera, including not only *Ageratum* but also *Fleischmannia* Schultz Bipontinus and *Conoclinium* (Fig. 2). No other genus of Eupatorieae exhibits the combination of alternate, sessile leaves, a coroniform pappus, and a glabrous style with clavate style appendages that characterizes *Paneroa*.

Paratypes. MEXICO. **Oaxaca:** Dist. Tlaxiaco, Mun. San Pedro Molinos, 3 Aug. 1994, *J. L. Panero & I. Calzada 4453* (MEXU, TENN, TEX); Dist. Juxtlahuaca, Mun. Santiago Juxtlahuaca, 13 Sep. 1995, *J. L. Panero & I. Calzada 5894* (IZTA, TENN, TEX). The following were brought to my attention by J. L. Villaseñor (pers. comm.) but were not seen: MEXICO. **Oaxaca:** Dist. Teposcolula, 25 July 1982, *A. García Mendoza 1080* (MEXU); Dist. Juxtlahuaca, Mun. San Juan Mixtepec, 3 Sep. 1989, *J. Reyes Santiago 1942* (MEXU); Yucudá, 19 Oct. 1990, *J. Reyes Santiago 2461* (MEXU); Dist. Nochixtlán, Mun. San Miguel Huautla, 13 Aug. 2004, *O. Téllez Valdés 16575* (MEXU).

Acknowledgments. Thanks are given to D. E. Schilling, S. Robertson, and H. Holloway for technical support; to Bobbi Angell for preparing the illustration; to R. Scott and J. L. Villaseñor for critical reviews of the manuscript and to the latter for bringing additional specimens of *Paneroa* to my attention; and to J. May of the University of Tennessee Molecular Biology Resource Facility for help with generation of DNA sequence data. Financial support was provided by grants from the Hesler Fund of the University of Tennessee and from the U.S. National Science Foundation (DEB-0343684).

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APPENDIX 1. List of vouchers for chloroplast DNA sequence data utilized to prepare Figure 2. Vouchers at TENN unless otherwise noted. GenBank numbers listed as *matK/ndhF/psbA-trnH*.

Ageratum houstonianum Miller: Cultivated, *E. E. Schilling 95-2*, EU337054/EU337042/EU337031; *Carphephorus corymbosus* (Nuttall) Torrey & A. Gray: U.S.A., Georgia, *E. E. Schilling 2036*, EU337049/EU337037/AY727174; *Chromolaena haenkeana* (DC.) R. M. King & H. Robinson: Mexico, Jalisco, *J. L. Panero 8841*, EU337052/EU337040/EU337029; *Conoclinium coelestinum* (L.) DC.: U.S.A., Arkansas, *E. E. Schilling 04-58*, EU337056/EU337044/EU337033; *Critonia sexangularis* (Klatt) R. M. King & H. Robinson: Mexico, Oaxaca, *J. L. Panero 2970* (TEX), EU337051/EU337039/EU337028; *Eupatorium hyssopifolium* L.: U.S.A., Florida, *K. C. Siripun 02-EUP-157*, EU337047/EU337035/AY727172; *Eutrochium maculatum* (L.) E. E. Lamont: U.S.A., New York, *E. E. Schilling 95-16*, EU337048/EU337036/EU337026; *Fleischmannia incarnata* (Walter) R. M. King & H. Robinson: U.S.A., Tennessee, *E. E. Schilling 95-21*, EU337055/EU337043/EU337032; *Hofmeisteria fasciculata* (Bentham) Walpers: Mexico, Baja California Sur, *J. L. Panero 2817*, EU337046/AF384731/EU337025; *Koanophyllon ayapanoides* (Grisebach) R. M. King & H. Robinson, Cuba, Holguín: *Bennet 7582*, EU337050/EU337038/EU337027; *Paneroa stachyofolia* (B. L. Robinson) E. E. Schilling: Mexico, Oaxaca, *J. L. Panero 4453*, EU337057/EU337045/EU337034; *Tamaulipa azurea* (DC.) R. M. King & H. Robinson: U.S.A., Texas, *E. E. Schilling 1146*, EU337053/EU337041/EU337030.

Nomenclatural Notes on *Garcinia* (Clusiaceae) from Madagascar and the Comoros

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Abstract. New results from phylogenetic analyses utilizing chloroplast and nuclear DNA markers agree with morphology in support of the unification of all of *Rheedia* L. and part of *Ochrocarpos* Thouars with *Garcinia* L. and show that species occurring in Madagascar and the Comoros fall into four separate lineages, which are designated here as informal species groups. An examination of *Garcinia* from these areas results in the recognition of 32 currently described species, all but one of which are endemic. The widespread African species, *G. livingstonei* T. Anderson, is noted for the first time to occur in Mayotte. Eleven new combinations are published here: *G. ambrensis* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. anjouanensis* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. arenicola* (Jumelle & H. Perrier) P. Sweeney & Z. S. Rogers, *G. calcicola* (Jumelle & H. Perrier) P. Sweeney & Z. S. Rogers, *G. dalleizettei* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. mangorensis* (R. Viguier & Humbert) P. Sweeney & Z. S. Rogers, *G. multifida* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. parvula* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. thouvenotii* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. tsaratananensis* (H. Perrier) P. Sweeney & Z. S. Rogers), and *G. urschii* (H. Perrier) P. Sweeney & Z. S. Rogers. Three new names, *G. dauphinensis* P. Sweeney & Z. S. Rogers, *G. megistophylla* P. Sweeney & Z. S. Rogers, and *G. tsimatimia* P. Sweeney & Z. S. Rogers, are provided for *O. parvifolius* Scott-Elliot, *R. megaphylla* H. Perrier, and *R. pedicellata* (Jumelle & H. Perrier) H. Perrier, respectively. Lectotypes are designated for 12 names: *G. crassiflora* Jumelle & H. Perrier, *G. disepala* Vesque, *G. melleri* Baker, *G. polyphlebia* Baker, *G. verrucosa* Jumelle & H. Perrier, *O. ambrensis* H. Perrier, *O. macrophyllus* O. Hoffmann, *O. parvifolius*, *O. parvulus* H. Perrier, *O. tsaratananae* H. Perrier, *R. arenicola* Jumelle & H. Perrier, and *R. calcicola* Jumelle & H. Perrier.

Key words: Clusiaceae, Comoros, *Garcinia*, Guttiferae, Madagascar, *Mammea*, *Ochrocarpos*, *Rheedia*, *Tsimatimia*, *Xanthochymus*.

When broadly circumscribed, the genus *Garcinia* L. contains more than 250 species (Jones, 1980; Stevens, 2006) of mostly small- to medium-sized dioecious trees and has a pantropical distribution with centers of diversity in Madagascar and Southeast Asia. *Garcinia mangostana* L., known by the common name mangosteen, is probably the most widely recognized member of the genus, being a popular fruit tree from Southeast Asia and the subject of a burgeoning herbal supplement industry. The genus is notable for its high sympatric species diversity (e.g., Whitmore, 1998; Lee et al., 2002; Thomas et al., 2003) and the large amount of morphological variation present in the flowers.

Almost since its inception, the limits of *Garcinia* and related genera, including four with representatives in Madagascar, i.e., *Ochrocarpos* Thouars, *Rheedia* L., *Tsimatimia* Jumelle & H. Perrier, and *Xanthochymus* Roxburgh, have been debated (e.g., Planchon & Triana, 1860; Vesque, 1893; Engler, 1893, 1925; Jumelle & Perrier de la Bâthie, 1910; Perrier de la Bâthie, 1948, 1951; Robson, 1958; Adams, 1970; Jones, 1980; Gustafsson et al., 2002; Stevens, 2006). In the last infrageneric classification of the group, Jones (1980) adopted a broad concept of the genus (including *Ochrocarpos* p.p., *Rheedia*, *Tsimatimia*, and *Xanthochymus*) and recognized 14 sections that were delimited largely by staminate floral morphology.

Recently, a broad-scale molecular phylogenetic study of *Garcinia* utilizing two nuclear DNA markers

(granule-bound starch synthase [GBSSI] and ITS) has been completed (Sweeney, 2008). The results of that study, which include a geographically, taxonomically, and morphologically comprehensive sampling of species, indicate that a broad circumscription of the genus *Garcinia* is supported (sensu Jones, 1980; Stevens, 2006) and suggests that the genus has representatives from four lineages in Madagascar and the Comoros. Two of these lineages have taxa that are widely treated as *Garcinia*, whereas the remaining two include members that were placed into the genera *Ochrocarpos* and *Rheedia* by Perrier de la Bâthie (1948, 1951).

Perrier de la Bâthie (1951) placed all Malagasy Clusiaceae with unisexual flowers and fused sepals in bud into *Ochrocarpos*. Kostermans (1956, 1961) and de Wilde (1956) both commented on the affinity of some species of *Ochrocarpos* to *Mammea* L., with de Wilde (1956) suggesting that *Ochrocarpos* in its entirety should be sunk into *Mammea*. While Kostermans (1956, 1961) thought that all of the Asian and some of the Malagasy *Ochrocarpos* should be moved into *Mammea*, he doubted that Malagasy *Ochrocarpos* completely belonged there, suggesting instead that *Ochrocarpos*, in part, should be maintained to include those species of the genus with phalangiate androecia and leaves lacking the higher order venation he considered to be characteristic of true *Mammea* (see below). Earlier, Vesque (1893: 482) regarded species of *Ochrocarpos* as being closely related to *Garcinia* and transferred *O. decipiens* Baillon into *Garcinia*. Jones (1980) and Stevens (2005) agreed that *Ochrocarpos* comprised two different groups of species, one related to *Garcinia* and the other to *Mammea*. The *Ochrocarpos* species related to *Garcinia* can be recognized by their seeds, which possess an embryo with a grossly swollen (vs. unswollen) hypocotyl and minute (vs. large) cotyledons, by the stamens arranged in phalangiate (vs. non-phalangiate or fasciculate) androecia in the staminate flowers, and by the leaves without punctate glands and with exudate-containing canals transversely intersecting the secondary veins (vs. leaves with punctate glands occupying the areoles and rarely with exudate-containing canals). Minute cotyledons are less than 1/10 of the length of the embryo, and large cotyledons account for most of the embryo (Brandza, 1908; Stevens, 2006). The affinity of the *Ochrocarpos* species possessing non-fasciculate androecia to *Mammea* has recently been supported by a combined phylogenetic analysis of molecular and morphological data (Notis, 2004), and the molecular phylogenetic study of Sweeney (2008) supports the placement of the *Ochrocarpos* species with phalangiate androecia in *Garcinia*. Kostermans (1956, 1961) and Stevens (2005) have transferred Malagasy species to *Mammea*, but four *Ochrocarpos* species with phalangiate androecia treated by Perrier de la Bâthie (1951) still lack valid names in *Garcinia*. Perrier de la Bâthie (1948, 1951) recognized *G. cauliflora* Baker, but Stevens (2005) transferred the species to *Mammea*, creating the combination, *M. cauliflora* (Baker) P. F. Stevens.

Earlier authors distinguished the genus *Rheedia* from *Garcinia* by its flowers possessing two sepals instead of four (e.g., Planchon & Triana, 1860; Engler, 1893, 1925). Robson (1958) correctly pointed out that this distinction breaks down when one takes into account the total variation within the two genera. Robson (1958) and later Adams (1970) argued for the inclusion of *Rheedia* in *Garcinia*, and this circumscription has been adopted in recent treatments (e.g., Kearns et al., 1998; Schatz, 2001). Molecular phylogenetic studies support this view (Gustafsson, 2002; Sweeney, 2008). Robson (1958) noted that *Rheedia* and *Garcinia* were published simultaneously and that, when united, *Garcinia* should be the preferred generic name in consideration of its size. Ten species recognized as *Rheedia* by Perrier de la Bâthie (1951) lack valid names in *Garcinia*.

Molecular phylogenetic data, strongly supported by morphology, suggest that the *Garcinia* of Madagascar and the Comoros belong to four different clades that generally correspond to previously recognized taxonomic sections within *Garcinia*. Each of these clades is made up of species that share unique combinations of morphological characters (Sweeney, 2008). The 32 species recognized in the synopsis (Table 1) are placed, using morphology, into one of four informal groups that correspond to those clades identified in the molecular analyses. While our groups roughly correspond to previously recognized sections, we do not assign species to formally named sections because our groups do not absolutely correspond to any previous author's circumscription. These groups can be identified with the accompanying key and illustrations of the staminate and pistillate flowers of representative species of all four groups (Figs. 1, 2). Fourteen species lack names in the genus, thus leading us to propose 11 new combinations and three new names for 10 species in *Rheedia* and for four species from *Ochrocarpos*.

The typification status of all names is addressed following the protocol employed by Turland and Jarvis (1997: 458–461). Our investigation is based on an examination of herbarium specimens deposited at B, BM, G, K, MO, P, TAN, and TEF.

A Key to the Four Species Groups of *Garcinia* in Madagascar and the Comoros

1a. Staminate flowers with a disk occupying the center of the flower; pistillate flowers with an annular or lobed disk beneath the ovary.

Table 1. The 32 species of *Garcinia* in Madagascar and the Comoros, their previous assignment in Perrier de la Bâthie (1951), and the species group to which each is assigned here. The four species groups are recognized by morphology and supported by evidence of the first author (Sweeney, 2008) utilizing the two nuclear DNA markers GBSSI and ITS.

Species group	Accepted name	Previous assignment
Brindonia group	*Garcinia asterandra* Jumelle & H. Perrier	*Garcinia asterandra* Jumelle & H. Perrier
	G. chapelieri (Planchon & Triana) H. Perrier	*G. chapelieri* (Planchon & Triana) H. Perrier
	G. crassiflora Jumelle & H. Perrier	*G. crassiflora* Jumelle & H. Perrier
Paragarcinia group	*Garcinia cerasifer* (H. Perrier) P. F. Stevens	*Ochrocarpos cerasifer* H. Perrier
	G. dauphinensis P. Sweeney & Z. S. Rogers	*O. parvifolius* Scott-Elliot
	G. decipiens (Baillon) Vesque	*O. decipiens* Baillon
	G. disepala Vesque	*O. multiflorus* O. Hoffmann
	G. madagascariensis (Planchon & Triana) Pierre	*Rheedia madagascariensis* Planchon & Triana
	G. melleri Baker	*O. madagascariensis* Choisy (non Planchon & Triana)
	G. multifida (H. Perrier) P. Sweeney & Z. S. Rogers	*O. multifidus* H. Perrier
	G. orthoclada Baker	*O. orthocladus* (Baker) H. Perrier
	G. parvula (H. Perrier) P. Sweeney & Z. S. Rogers	*O. parvulus* H. Perrier
	G. pauciflora Baker	*G. pauciflora* Baker
	G. polyphlebia Baker	*G. chapelieri* (Planchon & Triana) H. Perrier
	G. tsaratananensis (H. Perrier) P. Sweeney & Z. S. Rogers	*O. tsaratananae* H. Perrier
Rheedia group	*Garcinia ambrensis* (H. Perrier) P. Sweeney & Z. S. Rogers	*Rheedia ambrensis* H. Perrier
	G. anjouanensis (H. Perrier) P. Sweeney & Z. S. Rogers	*R. anjouanensis* H. Perrier
	G. aphanophlebia Baker	*R. aphanophlebia* (Baker) H. Perrier
	G. arenicola (Jumelle & H. Perrier) P. Sweeney & Z. S. Rogers	*R. arenicola* Jumelle & H. Perrier
	G. calcicola (Jumelle & H. Perrier) P. Sweeney & Z. S. Rogers	*R. calcicola* Jumelle & H. Perrier
	G. commersonii (Planchon & Triana) Vesque	*R. madagascariensis* (Planchon & Triana) H. Perrier
	G. dalleizettei (H. Perrier) P. Sweeney & Z. S. Rogers	*R. dalleizettei* H. Perrier
	G. livingstonei T. Anderson	
	G. mangorensis (R. Viguier & Humbert) P. Sweeney & Z. S. Rogers	*R. mangorensis* R. Viguier & Humbert
	G. megistophylla P. Sweeney & Z. S. Rogers	*R. megaphylla* H. Perrier
	G. pervillei (Planchon & Triana) Vesque	*R. pervillei* Planchon & Triana
	G. thouvenotii (H. Perrier) P. Sweeney & Z. S. Rogers	*R. thouvenotii* H. Perrier
	G. tsimatimia P. Sweeney & Z. S. Rogers	*R. pedicellata* (Jumelle & H. Perrier) H. Perrier
	G. urschii (H. Perrier) P. Sweeney & Z. S. Rogers	*R. urschii* H. Perrier
Xanthochymus group	*Garcinia capuronii* Z. S. Rogers & P. Sweeney	
	G. lowryi Z. S. Rogers & P. Sweeney	
	G. verrucosa Jumelle & H. Perrier	*G. verrucosa* Jumelle & H. Perrier

2a. Stamens and staminodes free in staminate and pistillate flowers . . . . Rheedia group (Fig. 1A–D)
2b. Stamens and staminodes phalangiate in staminate and pistillate flowers . . . . . Xanthochymus group (Fig. 1E, F)
1b. Staminate flowers lacking a disk and instead with a mushroom-shaped pistillode or with stamens occupying the center of the flower; pistillate flowers lacking a disk.
3a. Sepals 4 and free in bud; staminate flowers lacking a well-developed pistillode and stamens free; ovary in pistillate flowers and fruit with deep furrows down the septal radius . . . . . Brindonia group (Fig. 2A–E)
3b. Sepals usually 2 and fused in bud; staminate flowers with a mushroom-shaped pistillode and with stamens in phalanges; ovary in pistillate flowers and fruit usually lacking furrows down the septal radius . . . . . Paragarcinia group (Fig. 2F–H)

Discussion of Species Groups

Rheedia group

Thirteen members of this group (Table 1; Fig. 1A–D) were treated as *Rheedia* by Perrier de la Bâthie (1951) and were placed into Jones' (1980) invalidly published *Garcinia* sect. *Rheedia*. The new report of *G. livingstonei* T. Anderson from Mayotte material marks the first instance the species has been found occurring naturally outside of continental Africa. The 14 species of this group in Madagascar and the Comoros can be recognized by their staminate flowers having numerous free stamens surrounding a disk located in the center of the flower (or inserted on disk in *G. livingstonei*) and by their pistillate flowers with an annular disk beneath the ovary. The results of Sweeney (2008) suggest that the

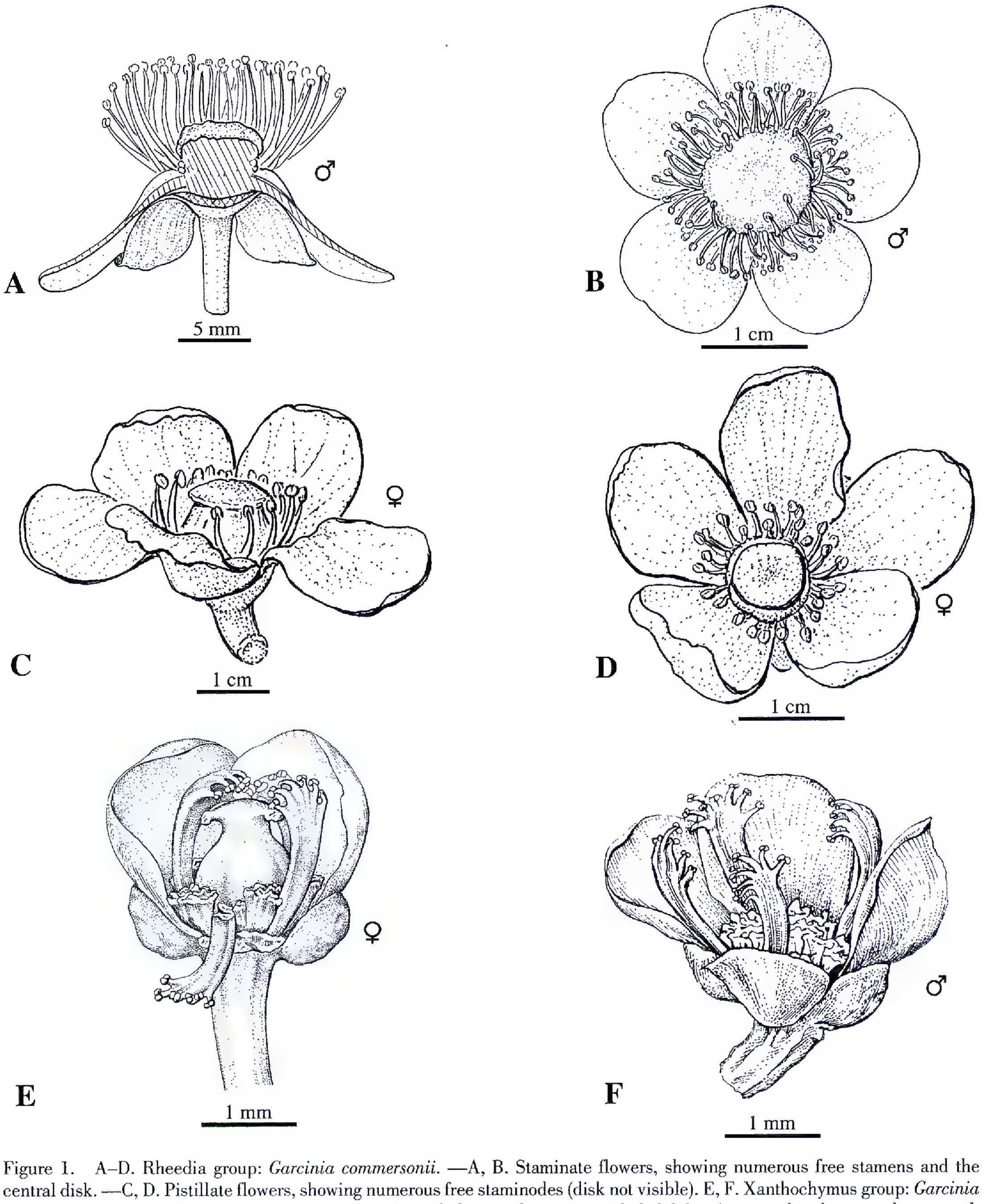

Figure 1. A–D. Rheedia group: *Garcinia commersonii*. —A, B. Staminate flowers, showing numerous free stamens and the central disk. —C, D. Pistillate flowers, showing numerous free staminodes (disk not visible). E, F. Xanthochymus group: *Garcinia lowryi*. —E. Pistillate flower, showing four antepetalous phalanges alternating with disk lobes (one sepal and two petals removed, phalange in foreground broken). —F. Staminate flower, showing four antepetalous phalanges and the central disk (one petal in foreground removed). Sources: A, B, *G. Schatz et al. 3371* (MO); C, D, *Service Forestier 22875* (MO); E, *N. Dumetz & G. McPherson 1156* (MO); F, *G. McPherson & N. Dumetz 14648* (TEF). A–D illustrated by J. Myers; E, F illustrated by L. R. Andriamiarisoa.

Malagasy and Comorian *Rheedia* and *G. livingstonei* are sister taxa, and that clade is sister to a clade of South American *Rheedia*. The entire Rheedia group plus the *G. livingstonei* clade is nested within a group of African *Garcinia* representing *Garcinia* sect. *Rheediopsis* Pierre (sensu Jones, 1980).

Included species. *Garcinia ambrensis* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. anjouanensis* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. aphanophlebia* Baker, *G. arenicola* (Jumelle & H. Perrier) P. Sweeney & Z. S. Rogers, *G. calcicola* (Jumelle & H. Perrier) P. Sweeney & Z. S. Rogers, *G. commersonii*

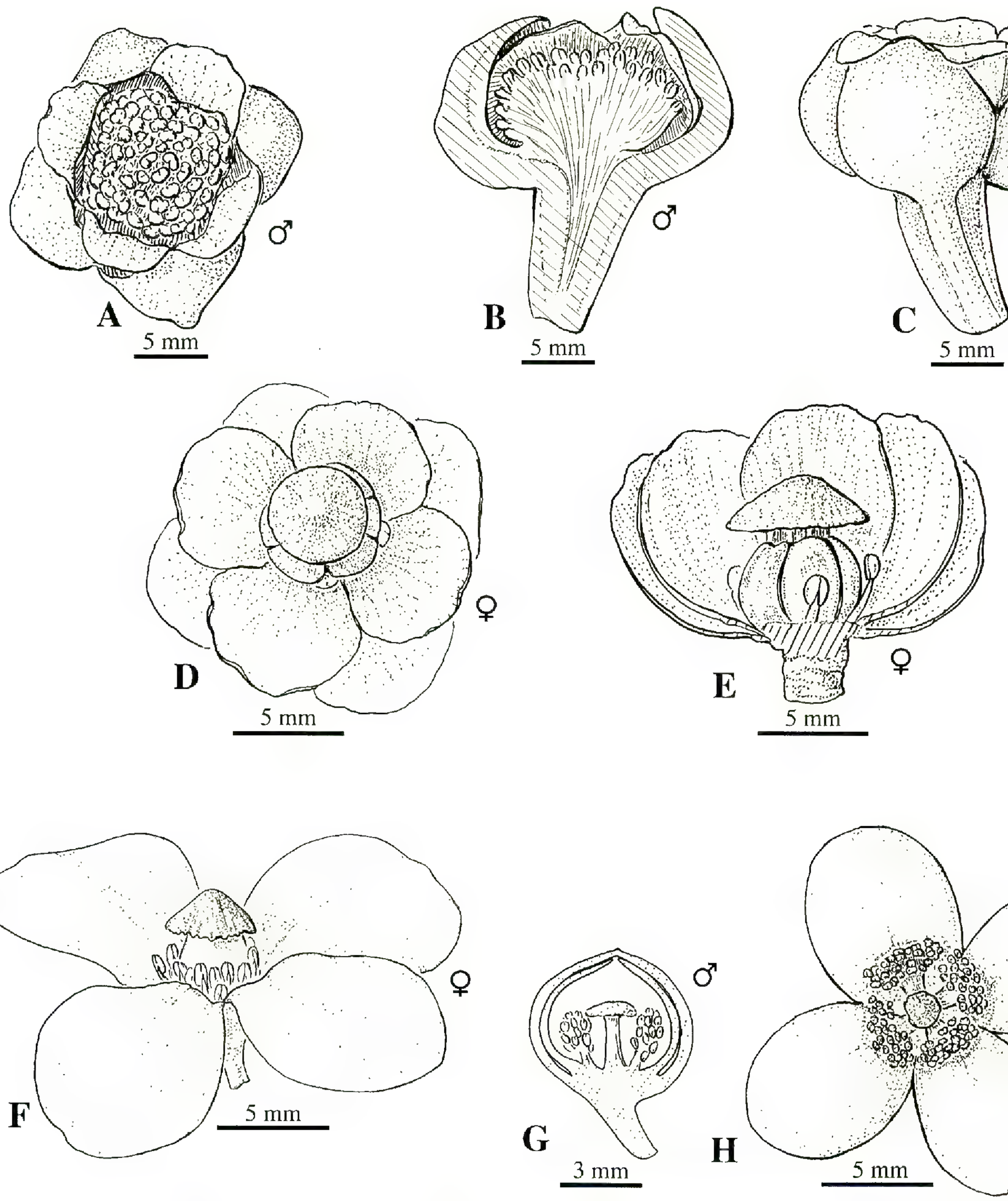

Figure 2. A–E. Brindonia group: *Garcinia chapelieri*. —A–C. Staminate flowers, showing four sepals, four petals, and numerous free stamens. —D, E. Pistillate flowers, showing several deep furrows down the septal radius of the ovary (E with two sepals and one petal removed). F–H. Paragarcinia group: *Garcinia decipiens*. —F. Pistillate flower, showing four petals (sepals not visible), several free stamens, the ovary, and the stigma. —G. Staminate flower bud, longitudinal section, showing fused two sepals, two petals, two phalanges, and the mushroom-shaped pistillode. —H. Staminate flower, showing petals, four antepetalous phalanges, and the pistillode. Sources: A–C, *G. Schatz et al. 3373* (MO); D, E, *P. Lowry et al. 4000* (MO); F, *J. Aridy & A. Moïse 183* (MO); G, H, *Service Forestier 21601* (P). All parts illustrated by J. Myers.

(Planchon & Triana) Vesque, *G. dalleizettei* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. livingstonei* T. Anderson, *G. mangorensis* (R. Viguier & Humbert) P. Sweeney & Z. S. Rogers, *G. megistophylla* P. Sweeney & Z. S. Rogers, *G. pervillei* (Planchon & Triana) Vesque, *G. thouvenotii* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. tsimatimia* P. Sweeney & Z. S. Rogers, *G. urschii* (H. Perrier) P. Sweeney & Z. S. Rogers.

XANTHOCHYMUS GROUP

Until recently, this group (Table 1; Fig. 1E, F) was represented in Perrier de la Bâthie (1951) by *Garcinia verrucosa* Jumelle & H. Perrier, an endemic Malagasy species, but two additional species were described by Rogers and Sweeney (2007). The three species representing this group in Madagascar are distinct from other Malagasy and Comorian *Garcinia* by having

staminate flowers lacking a pistillode and possessing four antepetalous phalanges that are composed of incompletely fused filaments surrounding a disk in the center of the flower and by their pistillate flowers with a lobed disk beneath the ovary (lobes alternate with the phalanges). *Garcinia verrucosa* is placed among a monophyletic group of species from *Garcinia* sect. *Xanthochymus* (sensu Jones, 1980) by molecular data (Sweeney, 2008). This clade has species distributed into Africa, Madagascar, India, Nepal, southern China, and Malesia (Sweeney, 2008).

Included species. *Garcinia capuronii* Z. S. Rogers & P. Sweeney, *G. lowryi* Z. S. Rogers & P. Sweeney, *G. verrucosa*.

BRINDONIA GROUP

In Madagascar this group (Table 1; Fig. 2A–E) contains three of the six species treated as *Garcinia* by Perrier de la Bâthie (1951) and is distinct from the other groups by having flowers with four sepals free in bud and staminate flowers that possess numerous stamens occupying the center of the flower (pistillode and disk absent), and by ovaries and fruits usually with deep furrows down the septal radius. Molecular phylogenetic analyses (Sweeney, 2008) suggest that these species fall within a group comprised almost entirely of taxa previously placed into *Garcinia* sect. *Brindonia* by Jones (1980).

Included species. *Garcinia asterandra* Jumelle & H. Perrier, *G. chapelieri* (Planchon & Triana) H. Perrier, *G. crassiflora* Jumelle & H. Perrier.

PARAGARCINIA GROUP

This strictly Malagasy group contains 12 species (Table 1; Fig. 2F–H) and largely corresponds to *Garcinia* sect. *Paragarcinia* (Baillon) Vesque sensu Jones (1980). Eight species were previously recognized (Perrier de la Bâthie, 1951) in *Ochrocarpos* sect. *Paragarcinia* Baillon, while a ninth was unplaced within *Ochrocarpos*. Two species, *G. pauciflora* Baker and *G. polyphlebia* Baker, were last treated under *Garcinia*, and *G. madagascariensis* (Planchon & Triana) Pierre was treated as a synonym of the invalid combination *Rheedia madagascariensis* (Perrier de la Bâthie, 1951). The Paragarcinia group is characterized by flowers with two sepals fused in bud (except *G. madagascariensis* and *G. pauciflora*) and staminate flowers with a mushroom-shaped pistillode and four to eight or more antepetalous (occasionally branched) phalanges of sessile to subsessile stamens. Phylogenetic analyses including species from this group suggest that it is a strongly supported clade comprised entirely of taxa endemic to Madagascar; however, the exact position of this lineage within *Garcinia* remains unresolved (Sweeney, 2008).

Included species. *Garcinia cerasifer* (H. Perrier) P. F. Stevens, *G. dauphinensis* P. Sweeney & Z. S. Rogers, *G. decipiens* (Baillon) Vesque, *G. disepala* Vesque, *G. madagascariensis*, *G. melleri* Baker, *G. multifida* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. orthoclada* Baker, *G. parvula* (H. Perrier) P. Sweeney & Z. S. Rogers, *G. pauciflora*, *G. polyphlebia*, *G. tsaratananensis* (H. Perrier) P. Sweeney & Z. S. Rogers.

A Synopsis of *Garcinia* in Madagascar and the Comoros

Thirty-two species of *Garcinia* are treated in this taxonomic synopsis (refer to Table 1 for species group designation). Thirty are endemic to Madagascar, *G. anjouanensis* is endemic to the Comoros, and *G. livingstonei* occurs in Mayotte and Africa. One dubious name, *Ochrocarpos madagascariensis* Choisy, is also discussed. This alphabetically arranged list includes 11 new combinations (*G. ambrensis*, *G. anjouanensis*, *G. arenicola*, *G. calcicola*, *G. dalleizettei*, *G. mangorensis*, *G. multifida*, *G. parvula*, *G. thouvenotii*, *G. tsaratananensis*, *G. urschii*) and three new names (*G. dauphinensis*, *G. megistophylla*, *G. tsimatimia*). Twelve names are lectotypified. *Garcinia ochrocarpoides* Jumelle & H. Perrier and *O. madagascariensis* were lectotypified by previous authors.

1. **Garcinia ambrensis** (H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Rheedia ambrensis* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 91. 1948. TYPE: Madagascar. "Près du lac Maudit, sur la Montagne d'Ambre, au N de la Grande Ile...," ♂ fl., *H. Perrier de la Bâthie 17730* (holotype, P030787; isotype, P030788).
2. **Garcinia anjouanensis** (H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Rheedia anjouanensis* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 91. 1948. TYPE: Comoros. "Anjouan...," ca. 700 m, fr., *Lavanchie 20* (holotype, P030789; isotype, P030790).
3. **Garcinia aphanophlebia** Baker, J. Linn. Soc., Bot. 25: 295. 1889. *Rheedia aphanophlebia* (Baker) H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 90. 1948. TYPE: Madagascar. "E. de la grande Ile...," ca. 500–1500 m, ♂ fl., *R. Baron next 5797* (holotype, K000240255; isotypes, K000240256, P030791).

The Kew sheet (K000240255) is the only relevant material bearing the collection number (i.e., "next 5797") as it was cited in the protologue (Baker, 1889:

295). On that sheet, someone anonymously marked out the "next 5797" and wrote in "5796." The other sheet at K (K000240256) is only numbered with "5796," whereas the final digit of the number on the P sheet (P030791) was changed anonymously from "7" to "6."

4. **Garcinia arenicola** (Jumelle & H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Rheedia arenicola* Jumelle & H. Perrier, Ann. Sci. Nat. Bot., sér. 9, 11: 269. 1910. TYPE: Madagascar. "...région de Madirovalo, dans le Boina, et près de Manongarivo, dans l'Ambongo...sablonneux secs du Bongo-Lava," Oct. 1900, ♂ fl., *H. Perrier de la Bâthie 1119 bis* (lectotype, designated here, P030792).

Several unvouchered localities in northwestern Madagascar were prominently mentioned in the protologue of *Garcinia arenicola* (Jumelle & Perrier de la Bâthie, 1910: 270). Three separate collections (*Perrier de la Bâthie 1119, 1119 bis, 1119 ter*), each represented by a single sheet in the P herbarium, bear some part of the locality information from the protologue. Two of these (*1119 bis, 1119 ter*) are annotated as types of the basionym in Perrier de la Bâthie's own hand, and *Perrier de la Bâthie 1119 bis* (P030792) is designated as the lectotype, as it is in the best condition. The two other collections are regarded as syntypes.

5. **Garcinia asterandra** Jumelle & H. Perrier, Ann. Sci. Nat. Bot., sér. 9, 11: 280. 1910. TYPE: Madagascar. "...Massif du Manongarivo...," 1400 m, ♂ fl., *H. Perrier de la Bâthie 5311* (holotype, P030763).
6. **Garcinia calcicola** (Jumelle & H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Rheedia calcicola* Jumelle & H. Perrier, Ann. Sci. Nat. Bot., sér. 9, 11: 266. 1910. TYPE: Madagascar. "...dans la Moyenne-Mahavavy,...le Tompoketsa,...environs de Majunga,... ravin d'Antsahobé...," Oct. 1904, ♂ fl., imm. fr., *H. Perrier de la Bâthie 1752* (lectotype, designated here, P030795).

Several unvouchered localities were mentioned in the protologue of *Rheedia calcicola* (Jumelle & Perrier de la Bâthie, 1910: 268). These place names have been traced to two collections (*Perrier de la Bâthie 1752* and *8148*) deposited in the P herbarium that were annotated as types of the basionym in Perrier de la Bâthie's own hand. Sheet P030795 of *Perrier de la Bâthie 1752* bears staminate flowers and immature fruit and, as the most complete collection, is designated as the lectotype. Two sheets of *Perrier de la Bâthie 8148* were found at P (P030793, P030794). These syntypes only bear fruits.

7. **Garcinia capuronii** Z. S. Rogers & P. Sweeney, Syst. Bot. 32: 773. 2007. TYPE: "Fianarantsoa, Kianjavato, entre Ifanadiana et Anosivolo," 6 Dec. 1964, ♀ fl., fr., *Service Forestier (Capuron) 23916* (holotype, P030776; isotypes, P030774, P030775, P030777, TEF).
8. **Garcinia cerasifer** (H. Perrier) P. F. Stevens, Harvard Pap. Bot. 9: 433. 2005. Basionym: *Ochrocarpos cerasifer* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 103. 1948. *Mammea cerasifer* (H. Perrier) Kostermans, Djawatan Kehutanan Indonesia Bagian Planologi Kehutanan, Djalen Perniagaan 44: 12. 1956. TYPE: Madagascar. "...Massif de l'Ikongo...," ca. 1400 m, fr., *R. Decary 5659* (holotype, P030860; isotypes, K00240251, P00389082, TAN000266).
9. **Garcinia chapelieri** (Planchon & Triana) H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 97. 1948. Basionym: *Ochrocarpos chapelieri* Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 14: 366. 1860. TYPE: Madagascar. s. loc., imm. fr., *L. Chapelier s.n.* (holotype, P030769).

Perrier de la Bâthie (1948, 1951) treated *Garcinia polyphlebia* as a synonym of *G. chapelieri*. An examination of the original material of *G. polyphlebia* and *G. chapelieri* at K and P indicates that the two are quite different morphologically and that *G. polyphlebia* is instead closer to the former *Ochrocarpos* species of *Garcinia* (i.e., the Paragarcinia group herein). Given these differences, we resurrect *G. polyphlebia* (treated below). Newly collected pistillate material at MO closely matches the type material of *G. chapelieri* vegetatively, and the ovaries and fruits of this material have several distinctive furrows down the septal radius. Perrier de la Bâthie (1951: 60) described the fruits of *G. chapelieri* as smooth; however, the fruit description was probably based on the type material of *G. polyphlebia* under the assumption that the two species were synonymous.

10. **Garcinia commersonii** (Planchon & Triana) Vesque, Monogr. Phan. 8: 484. 1893. Basionym: *Rheedia commersonii* Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 14: 312. 1860. TYPE: Madagascar. s. loc., ♀ fl., *P. Commerson s.n.* (holotype, P-JU 11865).

Garcinia pachyphylla Baker, J. Linn. Soc., Bot. 25: 295. 1889. TYPE: Madagascar. "North-west...," ♂ fl., *R. Baron 5757* (holotype, K000240238; isotypes, K000240239, P030798).

Ochrocarpos humblotii Drake, Bull. Mens. Soc. Linn. Paris 2: 1220. 1896, as "*Humbloti*." *Rheedia humbloti* (Drake) R. Viguier & Humbert, Rev. Gén. Bot. 25, bis: 637. 1914. TYPE: Madagascar. s. loc., ♂ fl., *L. Humblot 391* (holotype, P030800; isotypes, K000240243, K000240244, P030801, P030802).

Garcinia commersonii and its synonyms were previously recognized as synonyms of the invalid name "*Rheedia madagascariensis* (Planchon & Triana) H. Perrier" by Perrier de la Bâthie (1948: 92, 1951: 46). See further discussion of the name under *G. madagascariensis* (Planchon & Triana) Pierre. The provenance in the protologue of the original material (*Humblot 391*) for *Ochrocarpos humblotii* was cited as "Iles Comores, ou Madagascar?". However, Perrier de la Bâthie (1948: 92) indicated that the type was collected in the littoral forest of Madagascar, not the Comoros, and the taxon has apparently not been collected outside of Madagascar thus far.

11. Garcinia crassiflora Jumelle & H. Perrier, Ann. Sci. Nat. Bot., sér. 9, 11: 279. 1910. TYPE: Madagascar. "...dans le Manongarivo et le Sambirano," ♂ fl., fr., *H. Perrier de la Bâthie 5305* (lectotype, designated here, P030764; isotype, P030765).

In the protologue, Jumelle and Perrier de la Bâthie (1910: 280) cited the provenance of the original material as "Manongarivo et le Sambirano." Three relevant collections, *Perrier de la Bâthie 5305* (P030764, P030765), *5313* (P030767), and *5313 bis* (P030766), have been found at P, and all are annotated as types with the place of publication of the protologue in Perrier de la Bâthie's own hand, and bear inscriptions with at least one of the two place names mentioned in the protologue. *Perrier de la Bâthie 5305* (P030764) is the most complete specimen of the original material and is designated as the lectotype. The isolectotype consists of nothing more than a few fruits glued to the sheet. *Perrier de la Bâthie 5313* and *5313 bis* should be regarded as syntypes.

12. Garcinia dalleizettei (H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Rheedia dalleizettei* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 93. 1948. TYPE: Madagascar. "EST: Mt. Vatohazo, dans le bassin inférieur du Mangoro...," 300–400 m, ♂ fl., *H. Perrier de la Bâthie 18064* (holotype, P030796; isotype, P030797).

Two sheets of *Perrier de la Bâthie 18064* have been found at P. Sheet P030796 bears a lectotype sticker, but this is an error as the collection is the only original material cited in the protologue (Perrier de la Bâthie, 1948: 93).

13. Garcinia dauphinensis P. Sweeney & Z. S. Rogers, nom. nov. Replaced name: *Ochrocarpos parvifolius* Scott-Elliot, J. Linn. Soc., Bot. 29: 5. 1891. TYPE: Madagascar. "Woods near Fort Dauphin...," ♂ fl., *G. Scott-Elliot 2710* (lectotype, designated here, K000240237; isotypes, P00568804, P030823).

Two collections, *Scott-Elliot 2710* and *2840*, both noted to be collected near Fort Dauphin, were cited in the protologue (Scott Elliot, 1891: 5). The former, *Scott-Elliot 2710*, is the more complete collection, and the K sheet (K000240237), clearly annotated as the type specimen of *Ochrocarpos parvifolius*, is selected as the lectotype. The epithet *parvifolia* is validly occupied by *Garcinia parvifolia* (Miquel) Miquel (Miquel, 1864) for a species native to Peninsular Malaysia, Borneo, and Sumatra (Whitmore, 1973). We choose our new epithet to refer to the collection locality of the type specimen, but the species may occur as far north as the Masoala Peninsula.

14. Garcinia decipiens (Baillon) Vesque, Monogr. Phan. 8: 482. 1893. Basionym: *Ochrocarpos decipiens* Baillon, Adansonia 11: 370. 1876. TYPE: Madagascar. "Nossi-Bé, in humidis...," Jan. 1841, ♂ fl., *A. Pervillé 421* (holotype, P030815; isotypes, K000240241, P030816).

Ochrocarpos macrophyllus O. Hoffmann, Sert. Pl. Madagasc. 7. 1881. TYPE: Madagascar. "Nossi-komba," Dec. 1879, ♂ fl., *J. Hildebrandt 3239* (lectotype, designated here, P030818; isotypes, BM, K000240245, G00090054, P030817, P00462369).

Garcinia ochrocarpoides Jumelle & H. Perrier, Ann. Sci. Nat. Bot., sér. 9, 11: 275. 1910. *Ochrocarpos jumellei* R. Viguier & Humbert, Rev. Gén. Bot. 25, bis: 635. 1914, nom. illeg. superfl. TYPE: Madagascar. "Dans le massif du Manongarivo...bois du versant du Sambirano...," ♀ fl., *H. Perrier de la Bâthie 5312* (lectotype, designated by Perrier de la Bâthie, 1948: 109, P00462373).

The original material of *Ochrocarpos macrophyllus* (*Hildebrandt 3239*) deposited at B is no longer extant (R. Vogt, pers. comm.). Two sheets of original material are present at P, and the most complete (P030818) is designated as the lectotype.

Ochrocarpos jumellei R. Viguier & Humbert is illegitimate and superfluous according to Article 52.1 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006: 92–93) because Viguier and Humbert (1914: 635) did not adopt the available epithet of the clearly indicated basionym when publishing the name.

15. Garcinia disepala Vesque, Epharmosis, part 2: pl. 159. 1889. *Ochrocarpos multiflorus* O. Hoffmann, Sert. Pl. Madagasc. 7. 1881. TYPE:

Madagascar. "Nossi-komba, arbor ad littora maris floribus lacteis...," Feb. 1880, ♂ fl., *J. Hildebrandt 3337* (lectotype, designated here, G00090050 [stamp 724413]; isotypes, G00090049 [2], G00090050 [stamp 724412], K00380200, P030820, P030821).

Ochrocarpos multiflorus and *Garcinia disepala* are homotypic, the former having been published about eight years before the latter, but the epithet already existed in *Garcinia* for the validly published *G. multiflora* Champion ex Bentham (1851), a name that pertains to a widespread Asian species occurring in southern China, Taiwan, and northern Vietnam (Li et al., 2007).

The original material of *Hildebrandt 3337* deposited at B is no longer extant (R. Vogt, pers. comm.), so the sheet at G bearing the accession number G00090050 and stamped with 724413 is designated as the lectotype.

16. **Garcinia livingstonei** T. Anderson, J. Linn. Soc., Bot. 9: 263. 1867. TYPE: Africa. "Hab. in rupibus schistosis prope flumen Zambesi, in horto botanico Calcuttensi ex Africa culta," ♀ fl., *D. Kirk s.n.* (holotype, CAL not seen).
17. **Garcinia lowryi** Z. S. Rogers & P. Sweeney, Syst. Bot. 32: 775. 2007. TYPE: Madagascar. "Toliara, Fort-Dauphin, W of town in forest called Mandena, trail through Botanical Garden," 6 Dec. 1989, ♂ fl., *G. McPherson & N. Dumetz 14648* (holotype, MO; isotypes, P, TAN, TEF).
18. **Garcinia madagascariensis** (Planchon & Triana) Pierre, Fl. Forest. Cochich. 1(5): 5. 1883. Basionym: *Xanthochymus madagascariensis* Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 14: 305. 1860, as "*Xanthochymus ? madagascariensis*." TYPE: Madagascar. s. loc., ♂ fl., *P. Commerson s.n.* (holotype, P-JU 11879; isotype, P0303771).

The history of *Garcinia madagascariensis* and its basionym, *Xanthochymus madagascariensis*, has been confused in the literature and herbarium almost since the names were first published. The name "*Xanthochymus ? madagascariensis*" first appeared in Planchon and Triana (1860: 305) and was reproduced two years later in a reprint entitled *Mémoire sur la famille des Guttifères* (Planchon & Triana, 1862: 150).

Baillon (1877: 402) suggested that *Xanthochymus* should be united with *Garcinia* and erroneously cited page 303 of Planchon and Triana's publication. Pierre (1883) formally transferred the species to *Garcinia*, attributing authorship of the name incorrectly to Baillon, presumably because Baillon (1877) listed "*Xanthochymus madagascariensis* Pl. et Triana. Mém Guttif. p. 150. Habite Madagascar (Commerson)" as the basionym of *G. madagascariensis*.

Perrier de la Bâthie (1948: 97) referred the name *Garcinia madagascariensis* (with "Baillon ex Pierre" as the author) to an entity known to him only as an incomplete, unnumbered Commerson specimen housed at P (no accession number). In that publication, he went on to mention "*Xanthochymus madagascariensis* Pl. et Tri., *Mem. Ternstr. Gutt., 150*" in synonymy, which was an incorrect reference to the reprinted protologue appearing in the aforementioned *Mémoire sur la famille des Guttifères* (Planchon & Triana, 1862: 150). While Perrier de la Bâthie (1948: 97) did not provide a description of "*G. madagascariensis* Baillon ex Pierre," the species is noted in his key of *Garcinia* as having "Un gros rudiment styliforme de gynécée, coiffé d'un large stigmate rouge...," which could be accommodated within the description provided in the protologue of *X. madagascariensis*. In this instance, it seems that Perrier de la Bâthie (1948) recognized a taxon based on the type of *X. madagascariensis*, and thus referred to the same taxon recognized as such by Pierre (1883) and Planchon and Triana (1860). Curiously, only two years later Perrier de la Bâthie (1951) no longer recognized the name *G. madagascariensis*, referring to the name only as a synonym of his invalid combination, "*R. madagascariensis*."

Perrier de la Bâthie (1948: 92), under the genus *Rheedia*, created a new invalid combination, *R. madagascariensis*, which he also puzzlingly based on *Xanthochymus madagascariensis* Planchon & Triana, this time correctly citing "*Ann Sc. Nat. Bot., sér. 4, XIV* (1860), *305*" for the protologue of the basionym (Planchon & Triana, 1860: 305). He also cited "*Garcinia madagascariensis* H. Bn., Hist. Pl., VI, 402" as a synonym, providing the same erroneous place of publication and authorship as before. Perrier de la Bâthie (1948: 92) synonymized several names (*G. commersonii*, *G. pachyphylla*, *Ochrocarpos humblotii*, *R. commersonii*, and *R. humblotii*) with *R. madagascariensis*. All of these taxa are morphologically similar in having staminate flowers with free stamens arranged in a ring around a central disk, a characteristic of our Rheedia group. The original material of *R. commersonii*, like that of *X. madagascariensis*, is an unnumbered Commerson specimen, and this similarity apparently led Perrier de la Bâthie to mistakenly conclude that *R. commersonii* and *X. madagascariensis* were homotypic. However, this is extremely unlikely as the protologue of *X. madagascariensis* describes a plant quite different from that of the original material of *R. commersonii*. Our study suggests that the entity that Perrier de la Bâthie

(1948, 1951) referred to as "*Rheedia madagascariensis*" (nom. inval.) represents a distinct taxon and consequently needs a valid name in *Garcinia*. Aside from *X. madagascariensis*, we also agree that the names Perrier de la Bâthie (1948, 1951) placed into synonymy under *R. madagascariensis* refer to the same taxon. The name *R. commersonii* Planchon & Triana has priority when recognized as *Rheedia*, and *G. commersonii* (Planchon & Triana) Vesque is the correct name when *Rheedia* and *Garcinia* are united.

In regard to the original material of *Xanthochymus madagascariensis*, Planchon and Triana (1860: 305) mentioned one or more unnumbered Commerson collections in the protologue with the provenance statement, "Commerson in herb. A. L. de Jussieu et in herb. Thoüin, nunc Cambessèdes." In the Jussieu herbarium at P, we found a specimen attributed to Commerson (sheet 11879) that corresponds to the description in the protologue. This material consists of a branch with leaves and staminate flowers, and we consider it to represent holotype material overlooked most recently by Perrier de la Bâthie (1948, 1951). Another sheet in the general herbarium closely matches the P-JU specimen and presumably corresponds to the collection cited in the protologue that was originally housed separately as part of Thoüin's herbarium. We regard this specimen (P0303771) as an isotype duplicate. Both sheets closely resemble specimens subsequently collected from the southeast coast of Madagascar, an area where Commerson was known to have collected (Dorr, 1997: 93–95). This material may have also served as the basis for plate 348 labeled as *Garcinia madagascariensis* (without associated authorship or text) in Grandidier's *Atlas* (Drake, 1896).

19. Garcinia mangorensis (R. Viguier & Humbert) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Rheedia mangorensis* R. Viguier & Humbert, Bull. Soc. Bot. France 61: 131. 1914. TYPE: Madagascar. "...bords de la Sahamarirana entre Ampasimpotsy et Bevalanirano, province d'Andovoranto, district de Moramanga...," ca. 900 m, 24 Oct. 1912, ♀ fl., *R. Viguier & H. Humbert 1011* (holotype, P030803; isotype, G00018840).

20. Garcinia megistophylla P. Sweeney & Z. S. Rogers, nom. nov. Replaced name: *Rheedia megaphylla* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 90. 1948. TYPE: Madagascar. "Est (S), forêt orientale,...sur le Mt. Vatovavy à ouest de Mananjary...," ca. 400–500 m, ♂ fl., *R. Decary 13689* (holotype, P030804; isotype, P030805).

When attempting to provide a name in *Garcinia* for the combination *Rheedia macrophylla* (Martius) Planchon & Triana (Planchon & Triana, 1860), Verdcourt (1976: 262) published the illegitimate, superfluous new name *G. megaphylla* Verdcourt. He was apparently unaware that the combination was based on *G. macrophylla* Martius (Martius, 1841), basing his new name on "*Rheedia macrophylla* Planchon & Triana," rather than on the actual basionym (for a more complete discussion, see Hammel, 1989). Because the epithet "*megaphylla*" is validly occupied in *Garcinia*, a new epithet is needed for *R. megaphylla* when it is transferred to *Garcinia*. In keeping with the meaning conveyed in the replaced name and in reference to the very large leaves found in this species (perhaps the largest in the genus), we select the epithet "*megistophylla*," meaning very big leaves.

21. Garcinia melleri Baker, J. Linn. Soc., Bot. 20: 92. 1883. TYPE: Madagascar. "Between Tamatave and Antananarivo...," ♀ fl., *C. Meller s.n.* (lectotype, designated here, K000240242; isotype, P030819).

Ochrocarpos goudotianus Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 14: 365. 1860. TYPE: Madagascar. s. loc., 1830, imm. fr., *J. Goudot s.n.* (holotype, P00568801; isotype, G00090054).

Garcinia comorensis Drake, Bull. Mens. Soc. Linn. Paris 2: 1221. 1896. *Ochrocarpos comorensis* (Drake) R. Viguier & Humbert, Rev. Gén. Bot. 25, bis: 634. 1914. TYPE: Madagascar. Lac de Nossi-Vé, 11 Apr. 1882, ♀ fl. bud, *L. Humblot 144* (holotype, P; isotype, K000240247).

Garcinia melleri was previously recognized as a synonym of the name *Ochrocarpos madagascariensis* Choisy (with the incorrect authorship "DC.") in Perrier de la Bâthie (1948, 1951). However, the name *O. madagascariensis* is dubious in its application and is therefore treated as such at the end of the paper.

Two collections, *Baron s.n.* (K000380201) and *Meller s.n.* (K000240242, P030819), were cited as original material for *Garcinia melleri*. Earlier statements by Perrier de la Bâthie (1948: 110, 1951: 92) mentioning *Meller s.n.* as the type of the name cannot be considered an effective lectotypification, since a depository was not specified and none of the material at K or P bears any indication that Perrier de la Bâthie examined it. Thus, it is impossible to distinguish between the duplicates deposited in those herbaria, and the K sheet of *Meller s.n.* is now designated as the lectotype of the name because it is the most complete specimen.

The provenance of the type material of *Garcinia comorensis* was cited as "Iles Comores" in the protologue, but the notes for *Humblot 144* in the field book register at P provide contradictory information,

namely "*Garcinia comorensis* Drake, est daté du 11 avril 1882, Lac de Nossi-Vé. Grand arbre 20 m. Fleurs blanc crème, terre sablonneuse, 150 m. d'alt." No other collections of *G. melleri* have been made from the Comoros, so we infer that the protologue's provenance was probably an inadvertent mistake by Drake.

22. Garcinia multifida (H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Ochrocarpos multifidus* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 106. 1948. TYPE: Madagascar. "E. du Lac Aloatra à Menaloha...," ♂ fl., *G. Cours 672* (holotype, P030822).

23. Garcinia orthoclada Baker, J. Linn. Soc., Bot. 22: 446. 1887. *Ochrocarpos orthocladus* (Baker) H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 108. 1948. TYPE: Madagascar. s. loc., fr., *R. Baron 3633* (holotype, K000240240; isotype, P00462365).

Rheedia laka R. Viguier & Humbert, Bull. Soc. Bot. France 61: 131. 1914. TYPE: Madagascar. "...forêt d'Analamazoatra," ca. 1000 m, 3 Nov. 1912, fr., *R. Viguier & H. Humbert 1111* (holotype, P00462367; isotypes, B100158974, G00090051 p.p.).

Ochrocarpos ambrensis H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 107. 1948, syn. nov. TYPE: Madagascar. "Forêt de la Montagne d'Ambre,...sur roches volcaniques, près de Diégo-Suarez (Nord)...," ca. 1200 m, ♂ fl., *H. Perrier de la Bâthie 17548* (lectotype, designated here, P030814; isotypes, K000240257, P00568806, TAN000265).

The isotype of *Rheedia laka* at G (G00090051) is fragmentary, and the thick leafless branch on the left hand side of the sheet is excluded as it does not appear to represent the species.

Ochrocarpos ambrensis was described as a distinct species by Perrier de la Bâthie (1948: 107) with some reservations regarding its distinctness from *O. orthocladus* (≡ *Garcinia orthoclada*, sensu Baker). We cannot find morphological differences to retain this taxon as distinct from *G. orthoclada* and treat it here for the first time as a new synonym of that name. Two collections (*Perrier de la Bâthie 17548, 18892*), both noted as coming from Montagne d'Ambre, were cited in the protologue of *O. ambrensis* (Perrier de la Bâthie, 1948: 107). *Perrier de la Bâthie 17548* (P030814) has the most intact staminate flowers and is designated as lectotype. The other syntype, *Perrier de la Bâthie 18892* (P00568805), is in fruit.

24. Garcinia parvula (H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Ochrocarpos parvulus* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 108. 1948. TYPE: Madagascar. "...sur le massif du Tsaratanana et ses abords, Nord du Domaine central,...Sahandrakoto, au S. du Tsaratanana...," ca. 1500–2400 m, ♂ fl., *H. Perrier de la Bâthie 16179* (lectotype, designated here, P00462372; isotype, P00568803).

Two collections, *Decary 1059* (P) and *Perrier de la Bâthie 16179* (P [2]), were cited in the protologue (Perrier de la Bâthie, 1948: 108). The more complete P sheet (P00568803) of the latter collection is designated as the lectotype.

25. Garcinia pauciflora Baker, J. Linn. Soc., Bot. 20: 92. 1883. TYPE: Madagascar. "Forest of Analamazaotra...," imm. fr., *R. Baron 1382* (holotype, K000240235; isotypes, K000240236, P030779).

Garcinia cernua Baker, J. Linn. Soc., Bot. 22: 446. 1887. TYPE: Madagascar. s. loc., imm. fr., *R. Baron 2653* (holotype, K000240234; isotypes, K000240233, P030780).

Perrier de la Bâthie (1948: 96) invalidly published the infraspecific name "*Garcinia pauciflora* var. *depauperata*" without an accompanying Latin description. The name, based on *Viguier & Humbert 982*, refers to an entity he considered to be closely related to *G. pauciflora*. However, it is clear after comparing the type material with Perrier de la Bâthie's (1948, 1951) descriptions of the two taxa in question that they are not closely related because the invalid variety *depauperata* has the staminate flower morphology of the Brindonia group, whereas *G. pauciflora* belongs to the Paragarcinia group.

26. Garcinia pervillei (Planchon & Triana) Vesque, Monogr. Phan. 8: 485. 1893, as "*Garcinia ? Pervillei*." Basionym: *Rheedia pervillei* Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 14: 312. 1860. *Tsimatimia pervillei* (Planchon & Triana) Jumelle & H. Perrier, Ann. Sci. Nat. Bot., sér. 9, 11: 256. 1910. TYPE: Madagascar. "Île Nossibé...," 18 Jan. 1841, imm. fr., *A. Pervillé 407* (holotype, P030807; isotypes, P030808, P030809).

The genus *Tsimatimia* was created by Jumelle and Perrier de la Bâthie (1910: 263–264) to accommodate *Garcinia pervillei* and *T. pedicellata* Jumelle & H. Perrier (recognized below as *G. tsimatimia*), which they believed differed from related genera in a few characters of the calyx, androecium, and ovary. Perrier de la Bâthie (1948) himself later placed *Tsimatimia* in synonymy with *Rheedia*, based partly on the observation that both species had free stamens surrounding a disk. *Tsimatimia* has not been used by subsequent authors.

27. Garcinia polyphlebia Baker, J. Linn. Soc., Bot. 22: 447. 1887. TYPE: Madagascar. Central Madagascar, imm. fr., *R. Baron 3101* (lectotype, designated here, K000240249).

Two collections, *Baron 3064* (K000240248, K000240250, P030768) and *Baron 3101* (K000240249), were cited in the protologue of *Garcinia polyphlebia*. The K sheet of *Baron 3101* is designated as the lectotype because it is the only original element bearing the designation of type in what appears to be Baker's handwriting.

28. Garcinia thouvenotii (H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Rheedia thouvenotii* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 90. 1948, as "*Rheedia ? Thouvenotii*." TYPE: Madagascar. "Centre (E), forêt d'Analamazoatra...," 1000 m, ♂ fl., *E. Thouvenot s.n.* (holotype, P030810; isotypes, P030811, P030812).

29. Garcinia tsaratananensis (H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Ochrocarpos tsaratananae* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 108. 1948. TYPE: Madagascar. "Sylve à lichens et forét à mousses,...dans le massif du Tsaratanana," ca. 2000 m, ♂ fl., *H. Perrier de la Bâthie 16263* (lectotype, designated here, P00462368).

Two collections, *Perrier de la Bâthie 16262* (P00568807) and *16263* (P00462368), both from the Tsaratanana massif, were referred to indirectly by the provenance given in the protologue of *Ochrocarpos tsaratananensis* (Perrier de la Bâthie, 1948: 108). The latter collection number is flowering and is designated as the lectotype. The other syntype is in fruit. The epithet as originally provided was derived from a geographic locality and, according to Recommendation 60.D.1 of the ICBN (McNeill et al., 2006: 112), should take the form of an adjective, and thus the suffix of the epithet is adjusted here.

The name "*Ochrocarpos tsaratananae* var. *rotundifolius*" first appeared in Perrier de la Bâthie (1951: 86) followed by the phrase "Vig. et Humb., mss. in Herb. Mus. Paris," and a diagnosis and discussion in French without the necessary validating Latin. Characters cited as diagnostic in the protologue for this variety were based on two specimens and break down when additional collections are examined.

30. Garcinia tsimatimia P. Sweeney & Z. S. Rogers, nom. nov. Replaced name: *Tsimatimia pedicellata* Jumelle & H. Perrier, Ann. Sci. Nat. Bot., sér. 9, 11: 265. 1910. *Rheedia pedicellata* (Jumelle & H. Perrier) H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 90. 1948. TYPE: Madagascar. "...des terrains primitives gneissiques des forêts de l'Ankaizina...," 1908, ♂ fl., *H. Perrier de la Bâthie 5316* (holotype, P030806).

The *pedicellata* epithet is already in use in the genus for *Garcinia pedicellata* (G. Forster) Seemann, an endemic New Caledonian species (Smith, 1981; Jaffré et al., 2004). Thus, we establish the new name, *G. tsimatimia*, here for the Malagasy species. The epithet is based on *Tsimatimia*, the generic name of the basionym, which in turn was roughly based on the Malagasy common name "Tsimatimanota," meaning literally "not punished for sinning" in the Malagasy language. Our epithet is composed arbitrarily as supported by Art. 23.2 of the ICBN (McNeill et al., 2006: 45).

31. Garcinia urschii (H. Perrier) P. Sweeney & Z. S. Rogers, comb. nov. Basionym: *Rheedia urschii* H. Perrier, Mém. Mus. Natl. Hist. Nat., n.s., 24: 89. 1948. TYPE: Madagascar. "Centre (E), forêt d'Analamazoatra...," 1000 m, ♂ fl., *E. Ursch 42* (holotype, P030813).

32. Garcinia verrucosa Jumelle & H. Perrier, Ann. Sci. Nat. Bot., sér. 9, 11: 277. 1910. TYPE: Madagascar. "Sambirano,...bords du Ramena," 300 m, Aug. 1908, ♂ fl., *H. Perrier de la Bâthie 5314* (lectotype, designated here, P030782).

Four infraspecific taxa (subspecies "*orientalis*" and "*typica*," and varieties "*apiculata*" and "*piriformis*") were invalidly described under *Garcinia verrucosa* in Perrier de la Bâthie (1948: 95–96), all of which lack a validating Latin diagnosis or description. No original material was explicitly cited in the protologue of *G. verrucosa* (Jumelle & Perrier de la Bâthie, 1910: 277), thus a collection with staminate flowers cited as subspecies *typica* by Perrier de la Bâthie (1948) is chosen for the lectotype of the species. An examination of herbarium material of *G. verrucosa* collected subsequent to Perrier de la Bâthie's work indicates that the cited differences between his infraspecific taxa break down.

DOUBTFUL NAME

Ochrocarpos madagascariensis Choisy, Prodr. 1: 560. 1824, non *Ochrocarpos madagascariensis* Planchon & Triana, Ann. Sci. Nat. Bot., sér. 4, 14: 364. 1860. TYPE: Madagascar. s. loc., pl. 26 in Petit-Thouars, Hist. Vég. Isles Austral. Afriq. 1806 (lectotype, designated by Sprague, 1934: 89, pl. 26, Petit-Thouars, 1806).

Petit-Thouars first described the genus *Ochrocarpos* in his *Genera Nova Madagascariensia* (1805: 15)

without any validating description of a species, apparently basing the name on one of his own personal herbarium collections. Choisy (1824: 560) validated Petit-Thouars' generic description by providing a species description of *O. madagascariensis*, which he indicated as being based on an unnumbered Petit-Thouars specimen. Original material, which should have been deposited at P or possibly G-DC, was not found in either herbarium. Planchon and Triana (1860: 364) provided an amplified species description of *O. madagascariensis*, based on a different, unnumbered Petit-Thouars specimen at P, which we refer to the invalid "*Ochrocarpos planchonianus*" (discussed below).

Sprague (1934: 89), having been unable to locate any herbarium specimens traceable to Petit-Thouars, provided a detailed discussion of the history of *Ochrocarpos* and *O. madagascariensis*, and concluded that the only available original material of the taxon was plate 26 in the very rare "edition 2" of *Histoire Végétaux Recueillis dans les Isles Australes d'Afrique* (Petit-Thouars, 1806). Sprague reproduced the plate (labeled as *Ochrocarpos* and lacking accompanying text) in his publication and clearly indicated that the illustration should be regarded as the type. The plant figured in the illustration is an ample fruiting branch along with dissected young fruits and does not conflict with either Petit-Thouars' or Choisy's descriptions. However, both descriptions are so broad that specimens of many other species of Malagasy *Garcinia* would also not obviously conflict with either one, and the illustration is not identifiable to species.

Perrier de la Bâthie (1948: 103, 109) believed he had rediscovered the missing Petit-Thouars original material of the name at P, and annotated the sheet (no accession number) with the inscription, "Type très probable du genre *Ochrocarpos* Thouars et type de *O. madagascariensis* DC." The specimen is in poor condition, consisting of five detached leaves, and is unlikely to have been original material for Choisy's name. The specimen was not annotated as *O. madagascariensis* by anyone prior to Perrier de la Bâthie, and it obviously conflicts with the morphology of the plant figured in plate 26 of Petit-Thouars (1806). Leaves on the P sheet annotated by Perrier de la Bâthie are obovate and rounded or emarginate at their apex, while those figured in the plate of *O. madagascariensis* are elliptic with an acute apex. The leaves on this particular P sheet closely resemble those of *G. melleri* in shape, venation pattern, and color. Unfortunately, we have not found any material approximating Sprague's lectotype.

Perrier de la Bâthie (1948: 102) considered the sterile Petit-Thouars material on which Planchon and Triana (1860: 364) based their description of *Ochrocarpos madagascariensis* to be different from that which Choisy had used, leading him to publish the invalid name "*Ochrocarpos ? Planchonianus*" based on that same material and without the necessary Latin description or diagnosis. Two years later, Perrier de la Bâthie (1951: 92), beneath *O. madagascariensis* sensu Planchon & Triana (non *O. madagascariensis* sensu Choisy), treated the presumed original material as a young shoot or seedling of *Rheedia*, but he made no mention of the name *O. planchonianus*. The Petit-Thouars material is still extant in the general P herbarium (no accession number), and we agree that it most likely represents immature vegetation of an unidentifiable species belonging to the Rheedia group.

The authorship of *Ochrocarpos madagascariensis* has been incorrectly ascribed to de Candolle in all relevant literature since the name was first published in the *Prodromus*, despite the obvious footnote at the bottom of the first page of the Clusiaceae treatment indicating that Choisy authored the work (Choisy, 1824: 557–564). Botanists should be aware that several other Clusiaceae names published in the *Prodromus* pertaining to a number of other geographical areas have been erroneously attributed to de Candolle (for examples, consult the International Plant Names Index website, <http://www.ipni.org/index.html>).

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Asplenium badinii (Aspleniaceae), a New Endemic Fern Species from Minas Gerais, Brazil

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ABSTRACT. A new species of *Asplenium* L. (Aspleniaceae) is described and illustrated. *Asplenium badinii* Sylvestre & P. G. Windisch is an endemic species of the isolated forest clumps (capões) from Itacolomi State Park, from Minas Gerais, Brazil, in areas dominated by open rocky sites (campos rupestres). This environment is known for its high level of generic and specific endemism. The new species belongs to the *A. salicifolium* L. species group, with apical pinnae similar to lateral ones, smooth blades, and spores with echinate perispore. It is related to *A. juglandifolium* Lamark and *A. bradeanum* Handro. Diagnostic characters for *A. badinii* are the long basal segment on the acroscopic side of the proximal pinnae as well as the linear to linear-lanceolate scales on the stem.

RESUMO. Uma nova espécie de *Asplenium* L. é descrita e ilustrada. *Asplenium badinii* Sylvestre & P. G. Windisch é uma espécie endêmica dos capões de mata do Parque Estadual do Itacolomi, no Estado de Minas Gerais, Brasil, em área dominada por campos rupestres. Este ambiente é reconhecido pela ocorrência de um grande número de espécies e gêneros endêmicos. Esta espécie pertence ao grupo de *A. salicifolium* L. Possui pina apical conforme, lâmina glabra e esporos com superfície espinhosa. É afim de *A. juglandifolium* Lamark e *A. bradeanum* Handro. Os caracteres diagnósticos são o longo segmento presente no lado acroscópico da porção proximal das pinas basais e as escamas do caule linear-lanceoladas.

Key words: Aspleniaceae, *Asplenium*, Brazil, ferns, IUCN Red List, Minas Gerais, Pteridophyta, spleenwort.

Brade (1942) estimated the occurrence of ca. 63 species of *Asplenium* L. in Brazil. Tryon and Tryon (1982) suggested that 50 species are concentrated in southeastern Brazil, an area that is considered one of the main centers of diversity of pteridophytes in the Neotropics. According to Sylvestre (2001), this family is represented in Brazil by two genera: *Asplenium*, with 69 species, and *Antigramma* C. Presl, with three species. These fern taxa grow mainly in humid and shaded forests with terrestrial, epipetric, and epiphytic habits (Sylvestre, 2001).

During work on the first author's Ph.D. thesis on the Brazilian species of the family Aspleniaceae, a new species was discovered. The new species occurs at the base of the Pico do Itacolomi, which lies between the municipalities of Ouro Preto and Mariana, in the Brazilian state of Minas Gerais, within Itacolomi State Park. This area is dominated by campos rupestres or rocky open grasslands sites at higher altitudes, where large rock formations present islands of wet forests in protected places called capões. The gallery forests, along streams, extend altitudinally upward and link with these usually isolated forest clumps. The capões, at higher altitudes, are influenced by atmospheric humidity and clouds. Notably, the flora of the campos rupestres is significantly composed of endemic elements, both at the generic and species levels (Giulietti et al., 1997). According to the List of Threatened Plants from Minas Gerais state (Mendonça & Lins, 2000), two thirds of the threatened species of this state grow in the campos rupestres.

Asplenium badinii Sylvestre & P. G. Windisch, sp. nov. TYPE: Brazil. Minas Gerais: Ouro Preto, base do Itacolomi, zona sul, mata sobre quartzito, Sep. 1972, *J. Badini s.n.* (holotype, OUPR 21429, photo at RBR). Figure 1.

Rhizoma erectum, paleaceum, paleis linearibus vel lineari-lanceolatis, castaneis, clathratis, 0.6–2.0 cm longis, 0.7–2.0 mm latis, attenuatis, unicostatis. Folium pinnatum, petiolo 8–23 cm longo, lamina 25–40 cm longa, 20–22 cm lata; pinnis 5- ad 7-jugis, longe attenuatis, integris, proximalibus acroscopicis cum segmento lanceolato acuto, apicalibus conformibus; venis plerumque 2-furcatis, immersis. Sori lineares. Sporae echinatae.

Plants epipetric; roots fasciculate, covered by yellow-gold to brown hairs; stems erect, slightly curved on the apical portion, nonstoloniferous, apex densely covered by castaneous, clathrate, linear to linear-lanceolate scales (0.6–2 × 0.07–0.2 cm), with truncate to cordiform base, apex long attenuate, unicostate. Leaves pinnate, erect, clumped (2 to 6

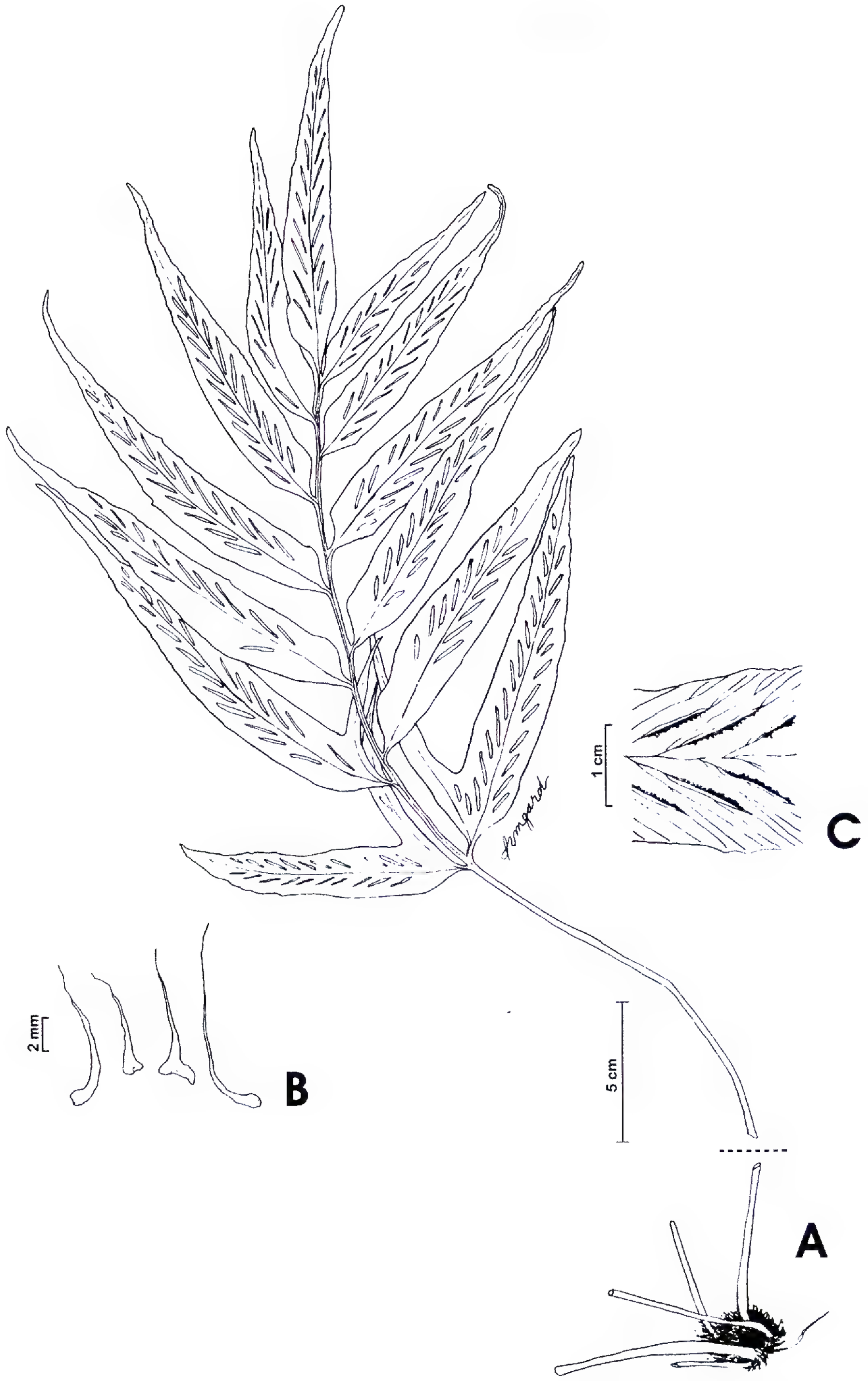

Figure 1. *Asplenium badinii* Sylvestre & P. G. Windisch. —A. Habit. —B. Stem scales. —C. Section of fertile pinnae, showing 2-forked venation and sori. Drawn from the holotype, *Badini s.n.* (OUPR 21429).

leaves per plant); petiole long (8–23 cm), ca. 1/5–1/3 the leaf length, straight to 1-sulcate on the adaxial surface, dull, gray-green, ca. 0.3–0.5 cm wide proximally, narrowing to apex, glabrous, not winged; blade 1-pinnate, chartaceous, light green, ovate to lanceolate, 25–40 × 20–22 cm, apex acute, not pinnatifid, base truncate; rachis green, glabrous, not winged; pinnae in 5 to 7 pairs, alternate, distant, long attenuate, falcate, petiolulate (petiolule ca. 1–2 mm); apical pinnae longer than lateral ones, similar in shape,

12–14 × 2–2.2 cm, base unequal, entire or sometimes auriculate; medial pinnae lanceolate, base subequilateral to truncate on the acroscopic side; basal pinnae lanceolate, longer than the medial ones (14–17 × 2–2.8 cm), base acroscopic, with lanceolate, acute segment, ca. 3–5 cm, generally overlapping the rachis abaxially, basiscopic side cuneate; veins immersed, free, twice forked, thickened at terminus; sori ca. 2 to 4 per 2 cm of the pinnae, linear along veins, ca. 1/2–2/3 the length between costa and margin, straight to slightly curved, basal sori occasionally diplazioid; indusia linear, membranaceous, concolorous, margin entire. Spores with echinate perispore, spines with wide base and apex slightly curved.

Distribution and habitat. *Asplenium badinii* is endemic to humid areas in isolated forest clumps or capões in Itacolomi State Park in Minas Gerais, Brazil, where it grows on rocks covered by humus near streams and in shaded places, at 1300 m elevation.

IUCN Red List category. *Asplenium badinii* is classified as Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001) because it is restricted to a small and threatened area, grows in isolated populations in specific habitats, and has not been collected since 1972. For these reasons, it is possible that the population is declining.

Etymology. The new species is named in honor of José Badini, professor at the Escola de Farmácia de Ouro Preto and collector of the type specimen.

Relationships. The new species is characterized by the long acroscopic segment on the basal pinnae, the immersed veins, the linear to linear-lanceolate stem scales, and the echinate perispore. It belongs to the *Asplenium salicifolium* L. group, especially by its echinate perispore and 1-pinnate leaf blade. *Asplenium badinii* is unique in having a lanceolate segment on the acroscopic side of the basal pinnae. *Asplenium juglandifolium* Lamark and *A. bradeanum* Handro differ by the absence of this segment on the pinnae. In addition, compared to *A. badinii*, *A. juglandifolium* and *A. bradeanum* have narrower stem scales (ca. 0.5 mm and 0.6–0.8 mm, respectively). *Asplenium badinii* has been confused with *A. oligophyllum* Kaulfuss based on the habit, the 1-pinnate leaf, the similarly shaped apical pinnae, and the texture of the leaf blades. However, *A. oligophyllum* differs by its broader stem scales (4–13 × 2–3 mm), the absence of a basal segment on the proximal pinnae, and its cristate perispore.

Paratypes. BRAZIL. **Minas Gerais:** Ouro Preto, Mata do Custódio, Sep. 1972, *J. Badini s.n.* (OUPR 21430), Sep. 1972, *J. Badini s.n.* (OUPR 21435), 1 Nov. 1970, *J. Badini s.n.* (OUPR 5910); base da Serra do Itacolomi, Lago do Manso, Feb. 1971, *M. A. Lisboa s.n.* (OUPR 4138).

Key to Brazilian Species of *Asplenium* with Erect Stems, 1-Pinnate Leaf Blade, and Terminal Pinnae Similar in Shape to Lateral Ones

1a. Spores with echinate perispore.
  2a. Acroscopic base of lateral pinnae with a round and obtuse auricle, usually overlapping the rachis; basiscopic side cuneate . . . . . *A. salicifolium* L.
  2b. Base of pinnae subequilateral or with an acute segment on acroscopic side.
    3a. Pinnae 1 to 2(4) pairs . . . . . *A. pearcei* Baker
    3b. Pinnae 6 to 20 pairs.
      4a. Stem scales narrow, ca. 0.5 mm wide . . . . . *A. juglandifolium* Lamark
      4b. Stem scales wider, 0.6–2 mm wide.
        5a. Acroscopic segment on basal pinnae lanceolate, acute . . . . . *A. badinii* Sylvestre & P. G. Windisch
        5b. Basal pinnae without acroscopic segment . . . . . *A. bradeanum* Handro
1b. Spores with cristate perispore.
  6a. Indusia elliptic, vaulted, with curved margins, ca. 5–7 mm long . . . . . *A. feei* Kunze ex Fée
  6b. Indusia linear, with straight margins, ca. 7–17 mm long.
    7a. Acroscopic side of pinnae cuneate; stem scales ovate-lanceolate, wide, ca. 2–3 mm wide, light brown . . . . . *A. oligophyllum* Kaulfuss
    7b. Pinnae bases with rounded segments (rarely lanceolate), bilateral; stem scales lanceolate, narrow, ca. 0.5 mm wide, black . . . . . *A. austrobrasiliense* (Christ) Maxon

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Nomenclatural Notes on the Fern Genus *Elaphoglossum* (Elaphoglossaceae) from China

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Abstract. During preparation of the taxonomic treatment of Elaphoglossaceae for the *Flora of China*, Volume 3, it was noticed that the following nomenclatural actions were necessary for the forthcoming account of *Elaphoglossum* Schott ex J. Smith: the new combination *E. luzonicum* Copeland var. *mcclurei* (Ching) F. G. Wang & F. W. Xing is made, and *E. spongophyllum* P. R. Bell ex Holttum is newly synonymized to it. In addition, *E. luzonicum* var. *mcclurei* is lectotypified, and *E. sinii* C. Christensen ex Wu is epitypified.

Key words: China, Elaphoglossaceae, *Elaphoglossum*.

Elaphoglossum Schott ex J. Smith (Elaphoglossaceae) comprises more than 600 species distributed throughout wetter parts of the tropics and subtropics, with the greatest diversity in the Neotropics (Holttum, 1954, 1978; Mickel & Atehortúa, 1980; Wu, 1999; Mickel, 2002; Lorence & Rouhan, 2004). The following actions are required for the forthcoming treatment of *Elaphoglossum* in the *Flora of China*, Volume 3.

1. Elaphoglossum luzonicum Copeland in Elmer, Leafl. Philipp. Bot. 1: 235. 1907. TYPE: Philippines. Island of Negros, Apr. 1908, *A. D. E. Elmer 9036* (holotype, MICH not seen; isotypes, BO not seen, K, L not seen, MO, P not seen, US not seen).

1a. Elaphoglossum luzonicum var. **luzonicum**

1b. Elaphoglossum luzonicum var. **mcclurei** (Ching) F. G. Wang & F. W. Xing, comb. et stat. nov. Basionym: *Elaphoglossum mcclurei* Ching, Sinensia 1: 55. 1930. TYPE: China. Hainan: Hung Mo shan, 22–27 Aug. 1929, *F. A. McClure 18257* (lectotype, designated here, SYS).

Elaphoglossum spongophyllum P. R. Bell ex Holttum, Blumea 14(2): 325. 1966. Syn. nov. TYPE: Indonesia. N Borneo: Mt. Kinabalu, Upper Kinataki R., *Clements 31869* (holotype, BO not seen).

Habitat and distribution. Creeping on mossy tree trunks in Hainan and Guangdong, China.

Discussion. *Elaphoglossum luzonicum* var. *mcclurei* is closely allied to *E. yoshinagae* (Yatabe) Makino, a common fern in South China, but *E. luzonicum* var. *mcclurei* differs by almost glabrous, much smaller fronds of rigidly coriaceous texture and by fertile fronds overtopping the sterile and much less scaly petioles (Ching, 1930). Furthermore, *E. luzonicum* var. *mcclurei* differs from *E. yoshinagae* by its rounded blade apices. *Elaphoglossum luzonicum* var. *mcclurei* is morphologically similar to *E. luzonicum* var. *luzonicum* but differs in its lamina margin with sparser or no spreading scales and in the frond base narrowly cuneate rather than cuneate or broadly cuneate in variety *luzonicum* (Wu, 1999). Because of these morphological similarities, *E. mcclurei* is better considered a variety of *E. luzonicum*, rather than as a separate species.

From specimens, field observations, and protologues, *Elaphoglossum spongophyllum* and *E. luzonicum* var. *mcclurei* share general characteristics such as the short-creeping rhizomes, rhizome scales acuminate with a few marginal hairs, similar leaf blade shape and size, and stellate scales on both surfaces of sterile laminae (Ching, 1930; Holttum, 1966). A Hainan specimen (*McClure 20066*, PE) was determined as *E.*

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mcclurei by R. C. Ching in 1932, but Holttum (1966) considered that *McClure 20066* belonged to *E. spongophyllum* and noted that this specimen has acuminate fronds that are much more decurrent at the base (Holttum, 1978). In agreement with Holttum's taxonomic opinion, as the two species cannot be clearly distinguished from each other, we reduce *E. spongophyllum* here as a synonym of *E. luzonicum* var. *mcclurei*.

In the protologue of *Elaphoglossum mcclurei* by Ching (1930: 55), one collection from Hainan without illustration was cited "Hung Mo Tung, 1830 m, *F. A. McClure 18257*, Aug. 22, 1929." However, the type status and the herbarium of deposit for this specimen were not designated by Ching. A specimen, without the word "type" but noted as "duplicate" was found in SYS, and is here designated as lectotype according to Art. 9.2 of the *International Code of Botanical Nomenclature* (McNeill et al., 2006).

Representative specimens examined. CHINA. **Guangdong**: Ruyuan, Wuzhi Mtn., Xiaohuang Mtn., *Y. H. Yan 2495* (IBSC). **Hainan**: Lingshui, *F. A. McClure 20066* (PE); Wanning, Xinglong, *F. W. Xing 6191* (IBSC); Baoting, Mao'an village, *Hainan Veg. Exped. 00807* (IBSC); Dungka to Wiu Fash, *N. K. Chun 43729* (IBSC); Changjiang, Bawangling, *S. Y. Dong, X. C. Zhang & Z. C. Chen 116* (IBSC, PE).

2. Elaphoglossum sinii C. Christensen ex Wu, Bull. Dept. Biol. Sun Yatsen Univ. 3: 346, pl. 164. 1932. TYPE: China. Guangxi: Yao-shan, Sheng-Tang-Ting, 29 July 1928, *S. S. Sin 611* (holotype, IBSC). EPITYPE: China. Guangxi: Yao-shan, Xinchun, 27 July 1936, *C. Wang 39632* (epitype, designated here, IBSC; duplicates, IBK, PE).

Habitat and distribution. Creeping on mossy rocks or tree trunks in Fujian, Guangxi, and Yunnan, China.

Discussion. *Elaphoglossum sinii* is unique in the genus by its long-creeping rhizomes and rounded, ovate, or elliptic fronds. In the protologue of *Elaphoglossum sinii* by Wu et al. (1932), only one collection was cited; this collection was noted as from Guangxi but the herbarium was not specified. We located *Sin 611* in IBSC, but the specimen does not have a fertile frond. The collection *C. Wang 39632* is chosen as an epitype because it comprises sterile and fertile fronds, and shares characteristics and close location with the original type specimen.

Representative specimens examined. CHINA. **Fujian**: Chong'an Xian, Huanggang Mtn., *Z. P. Jian & Q. Q. Zhang 400936* (PE) [new record for Fujian]. **Yunnan**: Mar-Li-Po, Hwang-gin-Yin, *C. W. Wang 86370* (PE).

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Stenogyne kauaulaensis (Lamiaceae), a New Species from Maui, Hawaiian Islands

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Abstract. *Stenogyne kauaulaensis* K. R. Wood & H. Oppenheimer (Lamiaceae), a narrow endemic from Kaua'ula, West Maui, Hawai'i, U.S.A., is described and illustrated. The new species differs from other known species of *Stenogyne* Bentham by its combination of flowers raised on a common peduncle, broadly campanulate calyx with large foliaceous teeth, strongly falcate corolla, and exserted stamens. Known from approximately 15 naturally occurring individuals, *S. kauaulaensis* easily falls into the Critically Endangered IUCN Red List category and is successfully cultivated for conservation.

Key words: Hawaiian Islands, IUCN Red List, Lamiaceae, *Stenogyne*, West Maui.

Stenogyne Bentham (Lamiaceae), as currently delimited, is a genus endemic to the Hawaiian Islands with primary diversity on the younger islands of Maui and Hawai'i (see Table 1). The endemic Hawaiian mints include two other genera, namely *Haplostachys* Hillebrand with five species restricted to the Hawaiian Islands, and *Phyllostegia* Bentham with 32 Hawaiian and two extra-Hawaiian species including one from Tahiti and one from Tonga (Wagner, 1999). *Phyllostegia* and *Haplostachys* are associated with insect pollination, being mostly white-flowered with a prominent lower lip and slight fragrance. *Stenogyne* is associated with flower visitation by honeycreepers, having representatives with falcate corolla tubes, abundant nectar production, and a variation of corolla colors including pink-red to deep purple (Weller & Sakai, 1990). Recent phylogenetic analyses of DNA sequence data indicate that the Hawaiian endemic mints derived from a single colonization event and are most closely related to North American *Stachys* L. from the Pacific coast (Lindqvist & Albert, 2002).

Sherff (1935) provided a preliminary revision of *Stenogyne* in which he recognized 24 species with numerous varieties. Subsequent studies of type specimens and recent publications (Weller & Sakai, 1990; Wagner & Weller, 1991, 1999) have revised species concepts in *Stenogyne*, recognizing 21 species and two subspecies. In the course of recent field research, a population of *Stenogyne* with unique floral characteristics was found in Kaua'ula, West Maui. Subsequent visits by the authors allowed for observation of the population during different phenological stages, and it became clear that this represented a previously undescribed species. This new discovery and description of *S. kauaulaensis* K. R. Wood & H. Oppenheimer brings the total number of *Stenogyne* species to 22.

Stenogyne kauaulaensis K. R. Wood & H. Oppenheimer, sp. nov. TYPE: U.S.A. Hawaiian Islands: West Maui, Lahaina Dist., SE slope of Kaua'ula Valley, 1025 m, 23 Jan. 2008, *H. Oppenheimer & J. Spencer H10817* (holotype, PTBG). Figure 1.

Haec species a congeneris floribus nonnullis pedunculo communi insidentibus, calyce late campanulato in dentes magnos foliaceos fisso, corolla valde falcata et staminibus exsertis differt.

Scandent or decumbent vines to several meters long; stems flexuous, spreading, 1–2.5 m, terete or weakly 4-angled, evenly pubescent to moderately tomentose, hairs spreading to slightly antrorse, occasionally glandular, young stems with pink- to purple-red tinge. Leaves light green, membranaceous, broadly ovate, blades 3.5–7(–9) × 2.5–4.7 cm, adaxially glabrate with sparse pubescence along midrib and veins, abaxially sparsely to densely pubescent, especially on midrib and veins, margins broadly crenate, occasionally crenate-denticulate, apex acute to attenuate, base cordate, rarely truncate, petioles 7–18 mm, densely pubescent, young growth with pink- to purple-red tinge. Flowers (5)6 per verticillaster, with (2)3 raised on peduncles (2–)5–9 mm, pubescent, bracts linear-filiform to subulate-filiform, often reflexed, ca. 6 × 1 mm, pubescent, pedicels (4–)7–11 mm, pubescent, occasionally glandular; calyx radially symmetrical,

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Table 1. Checklist of *Stenogyne* species with island distribution, federal status (USFWS, 2003), and comparison of floral characters relative to *S. kauaulaensis* (Hillebrand, 1888; Sherff, 1935; Weller & Sakai, 1990; Wood & Oppenheimer, pers. obs.). Distribution abbreviations: H, Hawai'i (Big Island); K, Kaua'i; L, Lana'i; M, Maui; Mo, Moloka'i; O, O'ahu. Status abbreviations: C, Candidate for Listing; E, Endangered; EX, Presumed Extinct; SOC, Species of Concern. Symbols: +, present; −, absent.

Species	Island distribution	Federal status	Peduncle present	Calyx broadly campanulate	Corolla strongly falcate	Stamens exserted
Stenogyne angustifolia A. Gray	Mo (EX), M (EX), H	E	−	−	−	−
Stenogyne bifida Hillebrand	Mo	E	−	−	−	−
Stenogyne calaminthoides A. Gray	H		−	−	+	−
Stenogyne calycosa Sherff	M	SOC	−	−	+	−
Stenogyne campanulata Weller & A. K. Sakai	K	E	+	+	−	−
Stenogyne cinerea Hillebrand	M	SOC, EX	−	−	−	+
Stenogyne cranwelliae Sherff	H	C	−	−	−	−
Stenogyne haliakalae Wawra	M	SOC, EX	−	−	+	+
Stenogyne kaalae Wawra subsp. *kaalae*	O		+	−	−	−
Stenogyne kaalae Wawra subsp. *sherffii* (O. Degener) W. L. Wagner & Weller	O	SOC	+	−	−	−
Stenogyne kamehamehae Wawra	Mo, M		−	−	+	−
Stenogyne kanehoana O. Degener & Sherff	O	E	−	−	+	−
Stenogyne kauaulaensis K. R. Wood & H. Oppenheimer	M		+	+	+	+
Stenogyne kealiae Wawra	K	C	−	−	−	−
Stenogyne macrantha Bentham	H	SOC	−	−	+	−
Stenogyne microphylla Bentham	M, H		−	−	−	−
Stenogyne oxygona O. Degener & Sherff	H	SOC, EX	−	−	−	−
Stenogyne purpurea H. Mann	K		−	−	−	−
Stenogyne rotundifolia A. Gray	M		−	−	−	+
Stenogyne rugosa Bentham	M (EX), H		+	−	−	−
Stenogyne scrophularioides Bentham	H	SOC	−	−	+	−
Stenogyne sessilis Bentham	L (EX), M, H		−	−	−	−
Stenogyne viridis Hillebrand	M	SOC, EX	−	−	−	−

broadly campanulate, inflated in live material and well separated from base and tube of corolla, 17–24 mm, pubescent to glandular-pubescent, becoming glabrate in fruit, teeth lanceolate-deltate, foliaceous, 7–10 × 5–8 mm at base, with distinct midvein, apex acute to acuminate; corolla purple, pubescent externally with scattered longer glandular hairs, glabrate within, light green tinge clouded along inner throat, tube strongly falcate, 20–24 mm, upper lip entire, 7–9 mm, lower lip 3-lobed, 3–5 mm; stamens purple, exserted beyond upper corolla lip. Nutlets ca. 8 mm.

Distribution and habitat. *Stenogyne kauaulaensis* is a narrow endemic currently known from only the southeastern rim of Kaua'ula Valley, West Maui, in the Hawaiian Islands (Fig. 2). A total of 15 plants of the new species occur in a single population, where three clusters grow within 600 m of each other and range in elevation from 975 to 1075 m. *Stenogyne kauaulaensis* grows in a region characterized by steep to vertical rocky slopes and windward-facing ridges. The plant community represents a relictual native mesic shrubland and forest with canopy heights ranging from 2 to 5 m. Dominant tree genera include *Metrosideros* Banks ex Gaertner, *Coprosma* J. R. Forster & G. Forster, *Diospyros* L., *Dodonaea* Miller, *Kadua* Chamisso & Schlechtendal, *Melicope* J. R. Forster & G. Forster, *Myrsine* L., *Nestegis* Rafinesque, *Sophora* L., and *Wikstroemia* Endlicher. Other less common trees include *Ilex* L., *Leptecophylla* C. M. Weiller, *Pipturus* Weddell, *Pleomele* Salisbury, *Santalum* L., and *Zanthoxylum* L. Understory vegetation is comprised of native shrubs, vines, and herbs including *Achyranthes* L., *Alyxia* Banks ex R. Brown, *Cocculus* DC., *Dubautia* Gaudichaud, *Freycinetia* Gaudichaud, *Liparis* Richard, *Lipochaeta* DC., *Lysimachia* L., *Nerau-dia* Gaudichaud, *Remya* Hillebrand ex Bentham & Hooker f., *Smilax* L., and *Vaccinium* L., in addition to ferns such as *Cyrtomium* C. Presl, *Doodia* R. Brown, *Dryopteris* Adanson, *Lepisorus* (J. Smith) Ching, *Microlepia* C. Presl, *Nephrolepis* Schott, and *Pteris* L.

Conservation status and threats. *Stenogyne kauaulaensis* should be considered critically endangered

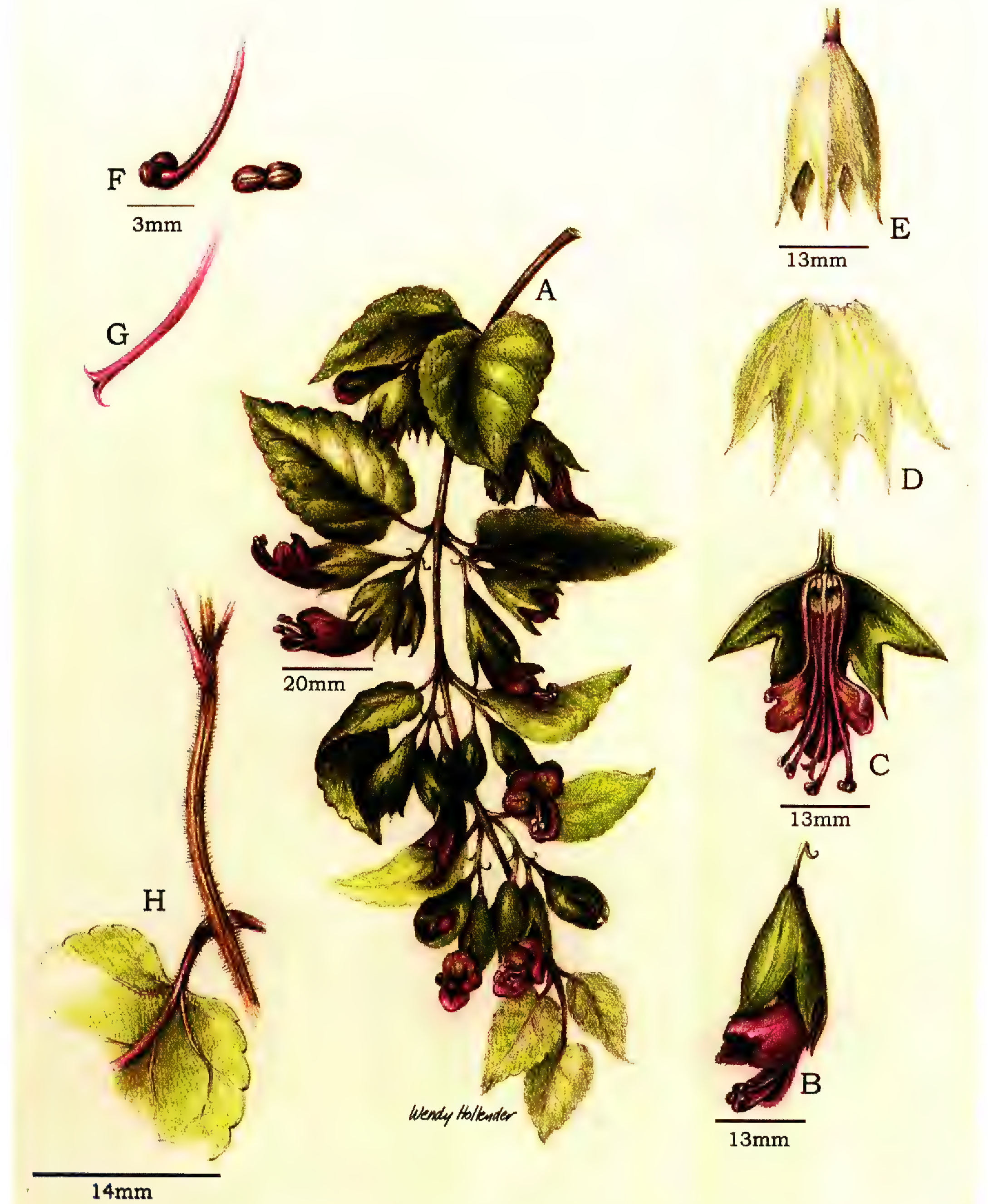

Figure 1. *Stenogyne kauaulaensis* K. R. Wood & H. Oppenheimer. —A. Flowering branch. —B. Single flower. —C. Longitudinal view of dissected corolla with stamens and pistil apparent. —D. Dissected calyx, interior. —E. Calyx. —F. Stamen with anther sacs. —G. Stigma and style. —H. Abaxial leaf surface and stem. Drawn from the paratype *Wood 12801* (PTBG).

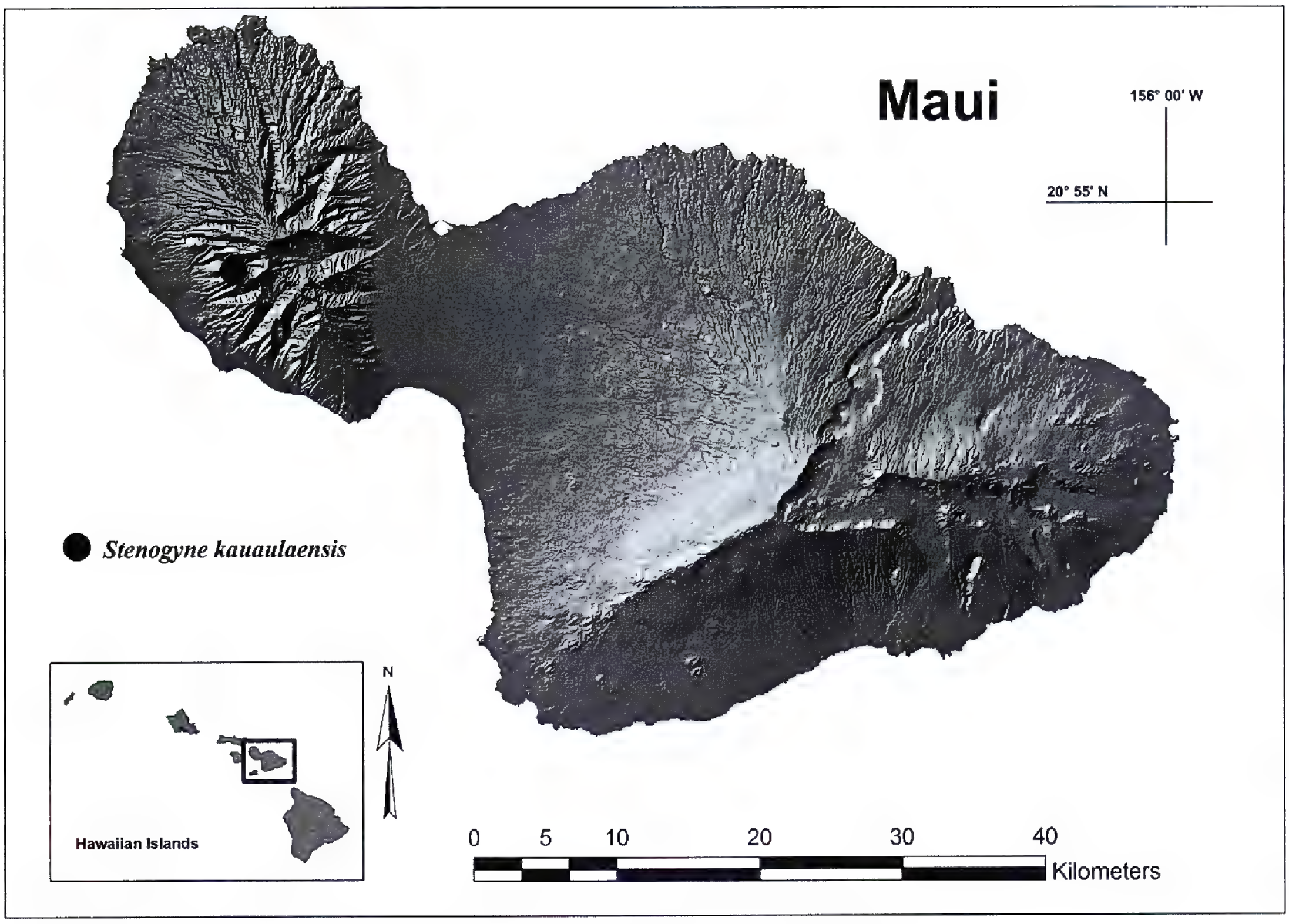

Figure 2. Location of *Stenogyne kauaulaensis* in Kaua'ula, West Maui, Hawai'i, U.S.A.

due to its limited range, low population numbers, probable loss of pollinators and/or dispersal agents, rockslides, herbivory by introduced slugs, and competition with non-native vegetation such as *Ageratina adenophora* (Sprengel) R. M. King & H. Robinson, *A. riparia* (Regel) R. M. King & H. Robinson, *Buddleja asiatica* Loureiro, and *Rubus rosifolius* Smith. Fire is also a serious threat to this ecosystem. In February 2007, a large brush fire in Kaua'ula Valley burned sections of nearby shrubland and came within 90 m of the two largest colonies of *S. kauaulaensis*. Early monitoring of successional vegetation has shown higher densities of fire-adapted, non-native grass species such as *Andropogon virginicus* L. and *Melinis minutiflora* P. Beauvois, raising the risk for future fire.

When evaluated using IUCN Red List criteria (IUCN, 2001), *Stenogyne kauaulaensis* falls into the Critically Endangered (CR) category, which designates this species facing the highest risk of extinction in the wild. *Stenogyne kauaulaensis* meets the IUCN criteria in having a range of less than 100 km^2, an area of occupancy of less than 10 km^2, presence in only a single location with a continuing decline inferred for the number of mature individuals, a continuing decline in the quality of habitat, and a population size of less than 50 mature individuals. Our formal evaluation can be summarized by the following IUCN hierarchical alphanumeric numbering system of criteria and subcriteria as CR B1ab(v)+2a-b(iii,v); D. *Stenogyne kauaulaensis* should also be listed by the U.S. Fish & Wildlife Service as Endangered under the Endangered Species Act of 1973, and a Recovery Plan should be written, funded, and implemented.

Cuttings collected from all three site locations of *Stenogyne kauaulaensis* are being successfully grown in Hawai'i at the National Tropical Botanical Garden, Lawa'i, Kaua'i; the Olinda Rare Plant Facility at Olinda, Maui; and Lyon Arboretum, Honolulu, O'ahu. Representative material of these ex situ plants is currently being grown and multiplied from stem cuttings and is slated to be out-planted in appropriate, secure habitat on West Maui.

Phenology. Flowering and fruiting of *Stenogyne kauaulaensis* have been observed between January and April.

Etymology. The new species is named for Kaua'ula Valley, a large amphitheater-shaped valley that cuts to the heart of the West Maui massif, where the holotype specimen was collected and the only known plants occur. Literally, kaua'ula means "the red rain" in Hawaiian (Pukui et al., 1974).

Affinities. *Stenogyne kauaulaensis* differs markedly from other known species of the genus by its combination of flowers raised on a common peduncle, a broadly campanulate calyx with large foliaceous teeth, strongly falcate corolla, and exserted stamens. Only three other species of *Stenogyne* share the character of flowers raised on a common peduncle, namely *S. campanulata* Weller & A. K. Sakai on Kaua'i, *S. kaalae* Wawra on O'ahu, and *S. rugosa* Bentham on both Maui and Hawai'i, yet none of these species has either falcate corolla tubes or exserted stamens, and only *S. campanulata* has a campanulate calyx. *Stenogyne campanulata* has other striking morphological differences from *S. kauaulaensis*, including densely tomentose leaves with serrate margins, a cream-yellow corolla tube with purple fringe along lips, and white stamen filaments.

Falcate corollas and exserted stamens represent a significant biological shift believed to be an adaptation toward bird pollination by honeycreepers, i.e., Drepanididae. Seven other species share the trait of falcate corolla tubes with *S. kauaulaensis*, yet none have a broadly campanulate calyx or, with the exception of *S. haliakalae* Wawra, have exserted stamens. *Stenogyne haliakalae*, one of four *Stenogyne* species considered extinct, also differs from *S. kauaulaensis* with its serrate leaf margins and bilabiate calyx with much smaller teeth (see Table 1 and the Key to the Maui species of *Stenogyne*, below).

The West Maui endemic *Stenogyne viridis* Hillebrand is comparable to *S. kauaulaensis* in having leaf margins broadly crenate, yet conspicuously differs in having only two flowers per verticillaster on short narrow pedicels and lacking peduncles. *Stenogyne viridis* is only known from the type collection made in 1870, *W. Hillebrand s.n.* (GH).

Paratypes. U.S.A. **Hawaiian Islands**: West Maui, Lahaina Dist., Kaua'ula Valley, SE rim on steep slopes, E colony, 20 June 2006, *K. R. Wood & H. Oppenheimer 11928* (PTBG), 24 Aug. 2006, *Wood & Oppenheimer 12096* (PTBG), 5 Dec. 2006, *Wood & Oppenheimer 12231* (PTBG); West Maui, Kaua'ula Valley, lower W colony, 24 Aug. 2006, *Wood & Oppenheimer 12099* (PTBG); East Maui, Olinda Rare Plant Nursery, cultivated from E colony, 8 Feb. 2008, *Oppenheimer & Hobdy H20801* (PTBG); Kaua'i, National Tropical Botanical Garden, Lawa'i Valley, cultivated from lower W colony, 15 Feb. 2008, *Wood 12801* (BISH, PTBG, US).

KEY TO THE MAUI SPECIES OF *STENOGYNE*

1a. Flowers raised on common peduncles. 2
1b. Flowers not raised on common peduncles 3
2a. Corolla tube strongly falcate; calyx broadly campanulate; flowers (5)6 per verticillaster; leaves with crenate margins, base cordate or rarely truncate . . . . . *S. kauaulaensis*
2b. Corolla tube straight; calyx weakly campanulate; flowers 2 to 16(to 24) per verticillaster; leaves with serrate margins, base acute, obtuse, truncate, or rarely somewhat cordate. . . . . *S. rugosa*
3a. Corolla tube (35–)45–56 mm long . . . . . *S. kamehamehae* Wawra
3b. Corolla tube 29 mm long or less 4
4a. Leaves 0.4–1.3(–2.7) cm long, margins crenate or lobed; calyx lobes obtuse or acute but not lanceolate; corolla tube greenish yellow, lobes brownish green to brownish pink. . . . . *S. microphylla* Bentham
4b. Leaves more than 1.5 cm long, margins crenate, serrate; calyx lobes acute or lanceolate in green-flowered species; corolla dark purple, red, pink, yellow, cream, green, or greenish yellow. 5
5a. Petioles absent or up to 4 mm in *S. sessilis* Bentham . . 6
5b. Petioles 4 mm long or more 7
6a. Stems terete, glabrous except at nodes; leaf margins broadly crenate; pedicels 8–9 mm long . . . . . *S. calycosa* Sherff
6b. Stems sharply or sometimes moderately 4-angled, glabrous or moderately to densely scabrous on stem ridges; leaf margins narrowly crenate or serrate; pedicels 3–8 mm long . . . . . *S. sessilis*
7a. Leaves narrowly ovate or elliptic to lanceolate or oblanceolate, ca. 4× as long as wide, glabrous . . . . . *S. angustifolia* A. Gray
7b. Leaves suborbicular, broadly ovate, or ovate to elliptic, occasionally lanceolate, less than 3× as long as wide, variously pubescent, hispid, or tomentose adaxially and/or abaxially, rarely glabrous. 8
8a. Corolla 12–17 mm long, tube straight; calyx teeth lanceolate, less than 5× as long as wide at base . . . 9
8b. Corolla 15–29 mm long (length unknown for *S. cinerea* Hillebrand), tube falcate; calyx teeth acute, or if lanceolate then 5× as long as wide at base . . . 10
9a. Flowers 2 per verticillaster; leaves 1.5–3.9 cm long, margins broadly crenate . . . . . *S. viridis*
9b. Flowers 2 to 16(to 24) per verticillaster; leaves 3.7–10 cm long, margins serrate . . . . . *S. rugosa*
10a. Flowers 2 to 6 per verticillaster; calyx teeth lanceolate; leaves gray tomentose on both sides, margins crenate . . . . . *S. cinerea*
10b. Flowers 6(to 8) per verticillaster; calyx teeth acute; leaves glabrous or sparsely hispid to pubescent but not tomentose, margins serrate 11
11a. Leaves broadly ovate, adaxially pubescent or occasionally glabrous, abaxially densely pubescent, apex acute, base obtuse or truncate; pedicels densely to sparsely pubescent. . . . . *S. haliakalae*
11b. Leaves suborbicular, glabrous or sparsely hispid, apex obtuse or occasionally acute, base cordate or occasionally truncate; pedicels hispid . . . . . *S. rotundifolia* A. Gray

The following couplets can be seamlessly inserted into the existing key to the species of *Stenogyne* (Weller & Sakai, 1990: p. 833) to accommodate *S. kauaulaensis*.

7(6). Calyx broadly campanulate 7a
7. Calyx tubular 8
7a(7). Corolla cream-yellow, tube straight or nearly so; stamen filaments white and not exserted beyond upper lip; calyx teeth 1/2 as long as wide, sometimes barely evident; leaves densely tomentose, margins serrate; Kaua'i . . . *S. campanulata*

7a. Corolla purple, tube falcate; stamen filaments purple and exserted beyond upper lip; calyx teeth as long or longer than wide; leaves glabrate or pubescent, margins crenate; W Maui. . . . *S. kauaulaensis*

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A New Species of *Paris* (Melanthiaceae) from Northeastern Yunnan, China

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ABSTRACT. *Paris stigmatosa* Shu-dong Zhang (Melanthiaceae) is described and illustrated from northeastern Yunnan, China. The new species was found growing in wet habitats under bamboo thickets on Yaoshan Mountain of Qiaojia County. The new species is very similar to *P. polyphylla* Smith, from which it differs by having fewer subsessile leaves (four to six), 3-merous flowers, and stigmas 21–34 mm long. A key to the new species and sympatric species is given, and their similarities are discussed.

Key words: China, IUCN Red List, Melanthiaceae, *Paris*, Yunnan.

The genus *Paris* L. (Melanthiaceae) (Angiosperm Phylogeny Group II, 2003) comprises more than 20 species of perennial herbs distributed in Eurasia (Li, 1986; Kato et al., 1995; Liang & Victor, 2000). All species except the European species *P. quadrifolia* L. and the Caucasian species *P. incompleta* M. Bieberstein are endemic to eastern Asia (Osaloo & Kawano, 1999). There are 22 species (12 endemic) in China (Liang & Victor, 2000), which is the center of species diversity and endemism for the genus.

The previous taxonomic circumscription of *Paris* has been problematic (e.g., Tatewaki & Sutô, 1935; Hara, 1969; Takhtajan, 1983; Li, 1984, 1986, 1998; Mitchell, 1987, 1988; Li & Noltie, 1997). Hara (1969) divided the genus into three sections, i.e., sections *Paris*, *Kinugasa* (Tatewaki & Sutô) Hara, and *Euthyra* (Salisbury) Franchet. Takhtajan (1983) suggested that *Paris* comprised three distinct genera: *Paris* s. str., *Kinugasa* Tatewaki & Sutô, and *Daiswa* Rafinesque. Li (1998), following Hara's (1969) treatment, maintained *Paris* s.l., dividing into two subgenera, subgenus *Daiswa* (Rafinesque) H. Li and subgenus *Paris*. In subgenus *Daiswa*, five sections were included, section *Dunniana* H. Li, section *Euthyra* (Salisbury) Franchet, section *Marmorata* H. Li, section *Fargesiana* H. Li, and section *Thibetica* H. Li; in subgenus *Paris*, three sections were included, section *Paris*, section *Kinugasa* (Tatewaki & Sutô) Hara, and section *Axiparis* H. Li. Previous molecular data (Osaloo & Kawano, 1999; Farmer & Schilling, 2002) supported Takhtajan's treatment in part; however, Ji et al. (2006) recently used nuclear ITS and plastid *psbA-trnH* and *trnL-trnF* DNA sequence data on a set of 21 species of *Paris* and confirmed that *Paris* s.l. is monophyletic. In this paper, we follow Li's (1998) treatment because of her comprehensive study for global *Paris* species.

Thirteen species were placed in *Paris* subg. *Daiswa* (Li, 1998) based on morphological characters such as thickened rhizomes, 1-loculed ovaries with parietal placentation, berry-like, irregularly dehisced capsules, and seeds with a succulent aril. There are 12 species of subgenus *Daiswa* in China, with 10 species occurring in Yunnan Province. Southwestern China (including Yunnan) clearly represents the center of diversity for *Paris* subgen. *Daiswa* (Gu & Li, 1988). Rising from the upper reaches of the Yangtze River,

Yaoshan Mountain lies along the border between northeastern Yunnan and southern Sichuan provinces. During recent fieldwork on Yaoshan Mountain by the authors, five taxa of *Paris* subgen. *Daiswa* were collected. Of these, *P. stigmatosa* is identified as a new species.

Specimens were collected on Yaoshan Mountain of northeastern Yunnan Province, and voucher specimens were deposited at the herbaria of Kunming Institute of Botany (KUN) and Yunnan University (YUKU). Flowers were observed directly in the field and rehydrated before most measurements and sketches were made. For the morphological descriptions, all materials were studied with the aid of a light microscope (Olympus TGHM, Tokyo, Japan). Pollen grains of the new species were collected in the field and examined by LM and SEM by the authors, because pollen exine sculptures play a key role in determining phylogenetic relationships among species of *Paris* (see Wei, 1988). Measurements were based on 20 pollen grains, the values of P (polar axis length) and E (equatorial diameter) were measured, and the P:E ratio was calculated.

Paris stigmatosa Shu-dong Zhang, sp. nov. TYPE: China. Yunnan: Qiaojia Co., Yaoshan Mtn., 2600–2900 m, 7 July 2004, *Hong Wang, Qin Lin, Shu-dong Zhang & Na-na Lin 03-1372* (holotype, KUN; isotypes, MO, PE, YUKU). Figure 1.

A *Paris polyphylla* Smith foliis obovatis subsessilibus, sepalis externis plerumque 3 atque stigmatibus 21–34 mm longis differt.

Plants perennial, erect; rhizome thickened to cylindrical, simple to 4 cm; stem green or purple, glabrous, 12–33 cm. Leaves 4 to 6; petioles subsessile; leaf blades obovate, glabrous, 4–9 × 2–3.5 cm, acuminate, cuneate. Fertile peduncles 3.5–11.5 cm, glabrous. Outer tepals typically 3, sometimes 4 or 2, green, ovate, 2–4.6 × 0.6–1 cm, glabrous, acuminate, cuneate, shortly ciliate at margin; inner tepals usually absent or 3, yellow-green, filiform, erect, equal to outer ones; stamens usually 6 or 8; filaments purple, 2–3 mm; anthers 3–5 mm; free portion of connective purple, ca. 0.2 mm, acute; ovary green, subglobose, 3–5.4 × 3–4.1 mm; style ca. 1 mm; stigmatic lobes 2, 3, or 4, purple, 21–34 mm; pollen prolate, monocolpate, rugulate-reticulate, 40.10 ± 2.49 × 21.24 ± 1.00 μm (Fig. 2). Capsule green at maturity, globose, 0.8–1 cm diam.; seeds enveloped by red, succulent aril, 4–5 × ca. 3 mm.

Distribution and habitat. *Paris stigmatosa* is an endemic species and has only been collected at the type locality on Yaoshan Mountain. Two populations with approximately 50 mature individuals each were found under moist bamboo thickets at altitude (2500–) 2600–2900 m.

IUCN Red List category. According to IUCN Red List criteria (IUCN, 2001), this species should be included in the category Critically Endangered (CR).

Phenology. Observed in flower May to July and in fruit in August.

Etymology. The epithet of the new species refers to its distinctive stigmas and is taken from the Latin "stigma" and the suffix "-osus," meaning "well developed." The elongate stigmas of *Paris stigmatosa* are conspicuous and are at least twice as long as stigmas known for other Chinese species.

Comparison to similar and sympatric species. Among the 12 individuals in the nine known specimens, two have three yellow-green, erect, filiform inner tepals. This also occurs in *Paris polyphylla* var. *pseudothibetica* H. Li found in Yunnan, on Yaoshan Mountain. According to Li's (1998) treatments, specimens with inner tepals were treated as *P. polyphylla* f. *pseudothibetica*, while specimens lacking inner tepals were *P. polyphylla* f. *macrosepala* H. Li. Li (1998) observed that both forms always appeared within the same natural population. In addition, Li (1998) also observed that the inner tepals could disappear in *P. polyphylla* f. *pseudothibetica* and grow out in *P. polyphylla* f. *macrosepala* in the greenhouse. The proportion of the two types was close to 1:1 (Li, 1998). There are also individuals with conical inner tepals noted for populations of *P. tetraphylla* A. Gray (Li, 1998) found far to the northeast in coastal Asia. Based on these observations, we consider that the absence of inner tepals should not be treated as a stable or diagnostic taxonomic character in *Paris*.

The long stigmas (up to 34 mm) in the new species *Paris stigmatosa* are unique. We examined stigma length in all species of *Paris* and found that only *P. tetraphylla* has long stigmas, but these are less than 12 mm. This species is distributed from Sakhalin Island, Russia, to Hokkaido, Honshu, and Shikoku, Japan. *Paris tetraphylla* does share some morphological characters with the new species, such as the inner tepals usually lacking and fewer outer tepals and stigmas (both typically four). However, it differs from the new species in having slender rhizomes, axile placentation, green style bases, and the same number of tepals and subtending leaves (typically four).

The new species *Paris stigmatosa* is similar to *P. polyphylla* in characters such as the number of tepals fewer than the leaves (5 to 11), the green calyxes, an inconspicuous free portion of anther connective, and

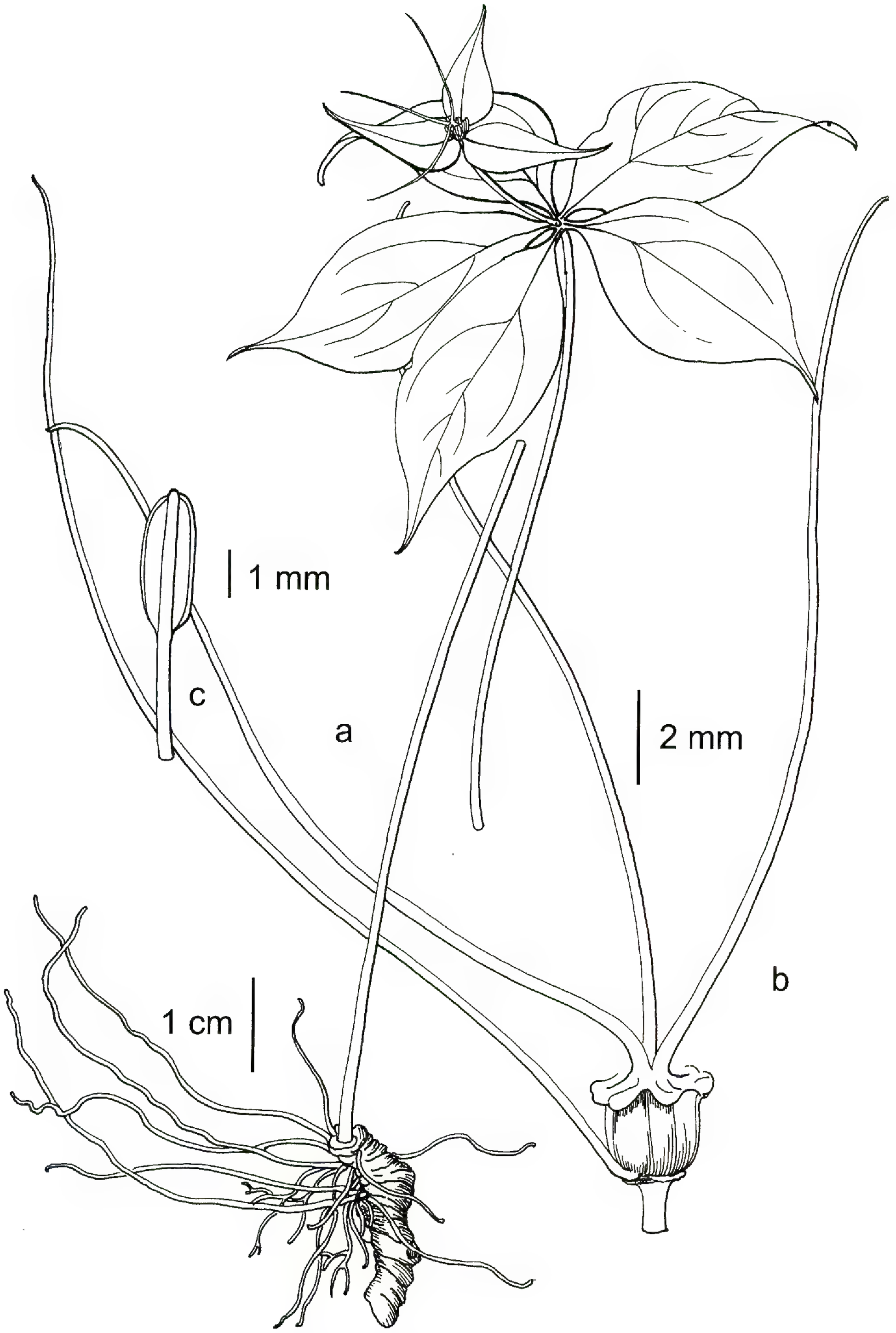

Figure 1. *Paris stigmatosa* Shu-dong Zhang. —a. Habit. —b. Pistil and inner tepal. —c. Anther. Drawn by Wang Ling from the holotype, *Hong Wang, Qin Lin, Shu-dong Zhang & Na-na Lin 03-1372* (KUN).

stamens twice as many as outer tepals. The new species differs from *P. polyphylla* in having subsessile petioles, obovate leaves, and much longer stigmas. *Paris polyphylla* varies in characters such as the number of leaves (5 to 11), the length of free portion of anther connective (inconspicuous or 0.5–2 mm), and the number of stigmatic lobes (Hara, 1969; Wang & Tang, 1978; Li, 1984, 1986). There are about 10

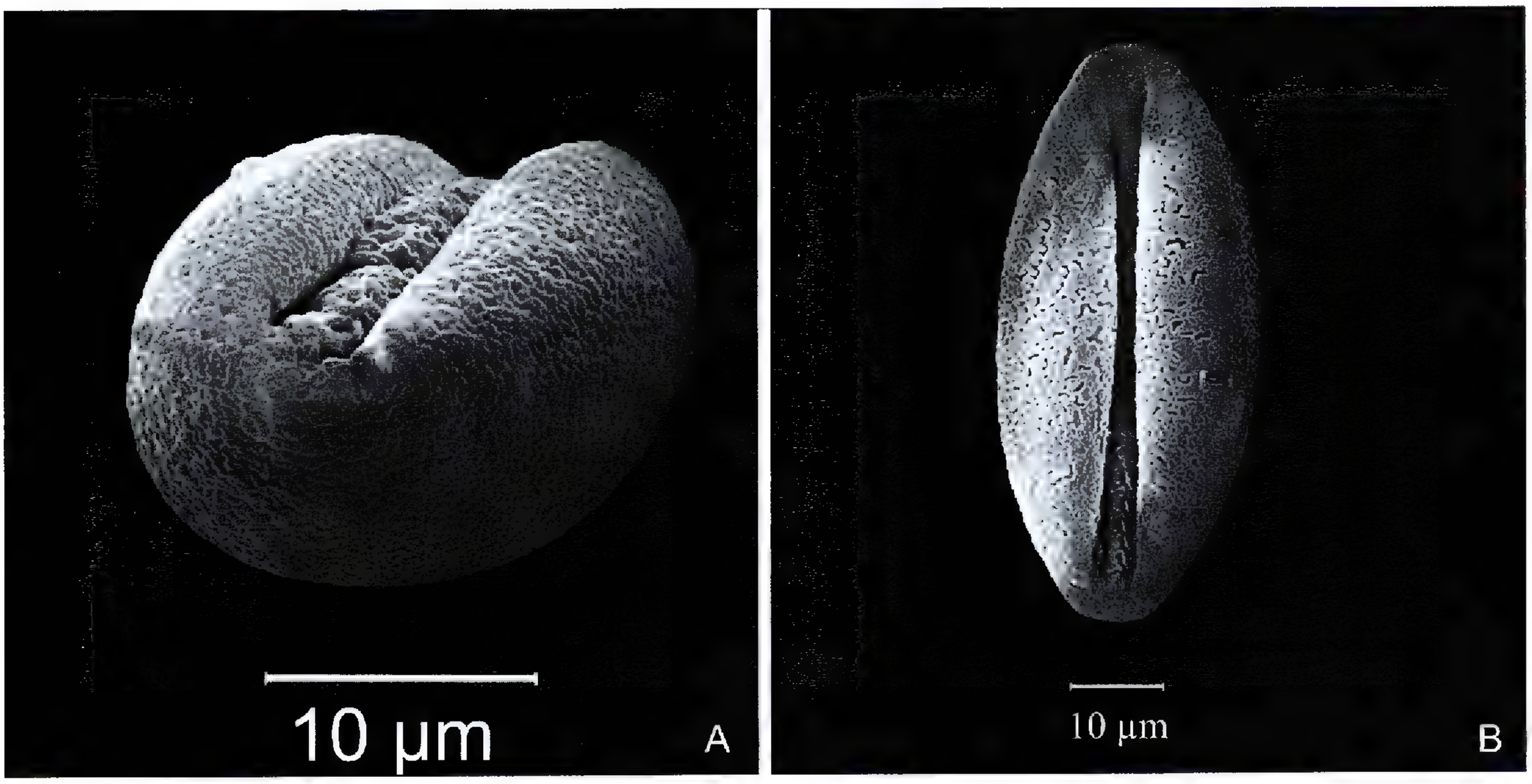

Figure 2. SEM images of pollen grains of *Paris stigmatosa* Shu-dong Zhang. —A. Polar view. —B. Equatorial view. Pollen from the paratype, *Hong Wang, Qin Lin, Shu-dong Zhang & Na-na Lin 03-1370* (KUN).

varieties recognized from China and nearby regions (Liang & Victor, 2000), and both *P. polyphylla* var. *stenophylla* Franchet and *P. polyphylla* var. *pseudothibetica* are sympatric with the new species. We found that *P. polyphylla* var. *stenophylla* was distinct from other varieties in *P. polyphylla* in having many more (10 to 15) lanceolate to linear-lanceolate leaves, and *P. polyphylla* var. *pseudothibetica* was unique in its conspicuous (3–10 mm) free portion of anther connective and in having a smaller number of apetalous individuals. We observed that *P. polyphylla* var. *pseudothibetica* and the new species grew in the same habitat. However, the new species is readily distinguished by its obovate versus oblong or oblanceolate leaves and subsessile petioles, even when both species were seen only as vegetation.

In addition to the varieties of *Paris polyphylla* mentioned above, *P. mairei* H. Léveillé, *P. marmorata* Stearn, and *P. delavayi* Franchet var. *petiolata* (Baker ex C. H. Wright) H. Li are also sympatric with *P. stigmatosa* on Yaoshan Mountain. *Paris marmorata* is easily distinguished due to the unique white mottling on its leaves. Typical specimens of *P. mairei* can be identified by their papillose pubescence; however, specimens collected from Yaoshan Mountain have little pubescence, but may be recognized by their purple fruits and oblanceolate to obovate-lanceolate leaves, while *P. delavayi* var. *petiolata* is easily identified in the field by its ovate-oblong leaves with a cordate or rounded base and the deflexed tepals equal in number to the leaves.

The new species is distinguished from other sympatric *Paris* species by the key below.

KEY TO SIX TAXA OF *PARIS* FROM YAOSHAN MOUNTAIN, NORTHEASTERN YUNNAN, CHINA

1a. Leaves dark green, with white mottling . . *P. marmorata*
1b. Leaves green, without mottling 2
2a. Plants papillose-pubescent; fruits purple . . . *P. mairei*
2b. Plants glabrous; fruits green 3
3a. Tepals of the same number as the leaves (6), outer tepals purple . . . . . *P. delavayi* var. *petiolata*
3b. Number of tepals often fewer than leaves, outer tepals green 4
4a. Leaves 4 to 6; stigmas 21–34 mm . . . . . *P. stigmatosa*
4b. Leaves 5 to 14; stigmas less than 10 mm 5
5a. Leaves lanceolate to linear; free portion of anther connective inconspicuous, only to 0.5 mm . . . . . *P. polyphylla* var. *stenophylla*
5b. Leaves lanceolate to oblanceolate; free portion of anther connective conspicuous, 3–10 mm . . . . . *P. polyphylla* var. *pseudothibetica*

Paratypes. CHINA. **Yunnan:** Qiaojia Co., Mt. Yao, 7 July 2004, *Hong Wang, Qin Lin, Shu-dong Zhang & Na-na Lin 03-1370* (KUN), 25 May 2005, *Shu-dong Zhang & Na-na Lin 03-1681* (KUN), 28 May 2005, *Shu-dong Zhang & Na-na Lin 03-1803* (KUN), 30 May 2005, *Shu-dong Zhang & Na-na Lin 03-1881* (KUN), 7 Aug. 2002, *Cheng-lin Dang 31043* (YUKU).

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Dioscorea bulbifera var. *albotuberosa* (Dioscoreaceae), a New Variety from Yunnan, China

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ABSTRACT. A study of the diversity of *Dioscorea bulbifera* L. (Dioscoreaceae) in China has revealed a distinctive new variety from Yunnan Province, China. *Dioscorea bulbifera* var. *albotuberosa* Y. F. Zhou, Z. L. Xu & Y. Y. Hang differs from *D. bulbifera* by its tubers white in transverse section, bulblets verruculose, and leaf texture membranaceous, papery, and crispy when dry.

Key words: China, *Dioscorea*, Dioscoreaceae, IUCN Red List, Yunnan.

Dioscorea bulbifera L. is distributed widely in Africa and Southeast Asia. According to Knuth (1924) and Prain and Burkill (1936), the species has 10 varieties, all with tubers yellow in transverse section, with three varieties (*D. bulbifera* var. *bulbifera*, *D. bulbifera* var. *simbha* Prain & Burkill, and *D. bulbifera* var. *heterophylla* Prain & Burkill) distributed in China. From 2002 to 2005, we committed ourselves to the revision of Chinese *Dioscorea* L., examining the specimens in five Chinese herbaria (KUN, HITBC, NAS, PE, South China Institute of Botany Academia Sinica). This paper validates the new variety as *D. bulbifera* var. *albotuberosa* Y. F. Zhou, Z. L. Xu & Y. Y. Hang.

1. **Dioscorea bulbifera** L., Sp. Pl. 2: 1033. 1753. TYPE: tab. 217 in Hermann, Parad. Bat., 1698 (lectotype, designated by E. Milne-Redhead, 1975: 9–10, tab. 217, Hermann, 1698).

1a. **Dioscorea bulbifera** var. **albotuberosa** Y. F. Zhou, Z. L. Xu & Y. Y. Hang, var. nov. TYPE: China. Yunnan: near Lancangjiang, Yong-jing-hong, 22°00′N, 100°47′E, 500 m, 24 Dec. 1957 (fr.), *C. T. Ting, T. S. Wang & J. S. Yue 0143* (holotype, NAS). Figure 1.

Haec varietas a ceteris varietatibus sinensibus tubere in sectione transversali albo, bulbillis verruculosis atque laminis foliaceis membranaceis distinguitur.

Stems twining to left, glabrous, smooth, cork black; bulblets brown, bitter-tasting with horned protuberances, variable in size, 0.3–0.9 cm diam., verruculose; tubers usually solitary, renewed annually, ovoid or pear-shaped, 2–8 cm diam., white in transverse section. Leaves alternate, simple, with petioles 5–8.5 cm, widely ovate, deeply cordate at base, tapering to cuneate apices, membranaceous, thin papery, crispy and splitting when dry, 6–8.5(–12) × 5–10 (–14.5) cm, glabrous, margin entire or slightly undulate, apex acuminate. Inflorescences spiciform; male spikes usually clustered in leaf axils or along leafless, axillary shoots, male flowers solitary along rachis, bract and bracteole ovate, base broad, apex acuminate; female spikes often 2 or 3 together, spikes drooping, 12–20 cm. Male flower sepals 2–3 mm with a purple perianth, corolla lobes lanceolate, ca. 2 mm; stamens 6, 0.6–0.8 mm, inserted at base of perianth, filaments nearly as long as anthers; female flowers similar to male, but with 6 staminodes, 3 spinous, ca. 1 mm, 3 as minute protuberances. Immature fruit green, drooping, reflexed at maturity; mature fruit straw-colored with dense purple maculae, oblong-globose, 2–3 cm long, glabrous; seeds inserted near apex of capsule, 1.2–1.6 × 0.4–0.5 cm, dark brown, seed wing pointing toward capsule base.

Distribution and habitat. *Dioscorea bulbifera* var. *albotuberosa* is distributed in forests, mixed forest margins, thickets, riverbanks, and along valleys, near 300 to 1600 m in southwest Yunnan.

IUCN Red List category. We assess the conservation status of this new variety as Vulnerable (VU B1) according to IUCN Red List criteria (IUCN, 2001), because it is estimated to be found in fewer than 10 locations and its geographic range is less than 20,000 km².

Phenology. Flowering from August to November; fruiting from September to December.

Relationships. *Dioscorea bulbifera* var. *albotuberosa* is a new variety of *D. bulbifera*, which is included in the section *Opsophyton* Uline. This section is distinguished by the usually solitary tubers, flowers with lanceolate lobes, six stamens ca. 1/4 as long as perianth lobes, reflexed capsules, and seed wings

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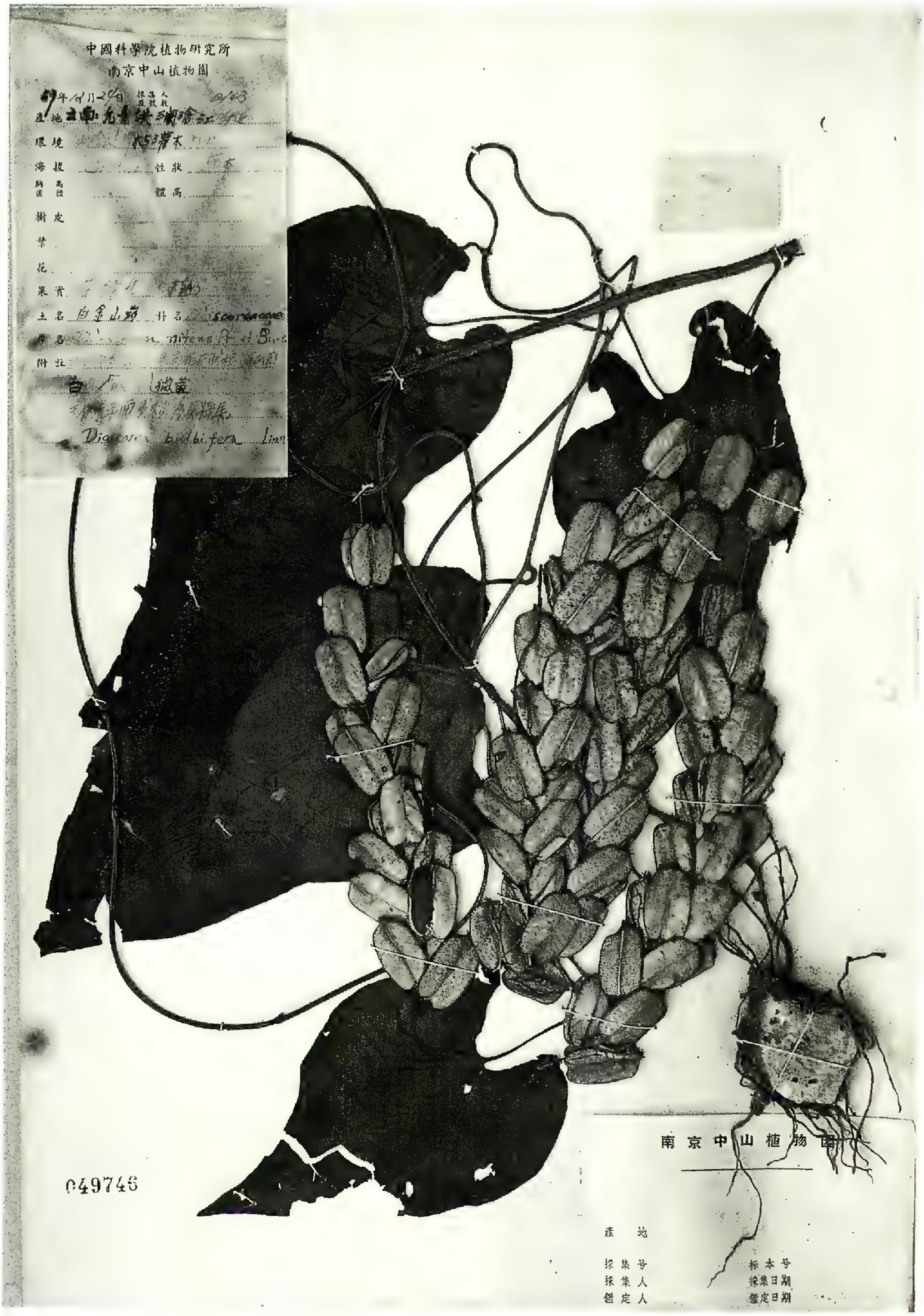

Figure 1. Holotype of *Dioscorea bulbifera* var. *albotuberosa* Y. F. Zhou, Z. L. Xu & Y. Y. Hang (*C. T. Ting. et al. 0143*, NAS). Photo by Songhu Tian.

inserted near the capsule apex (Ding & Michael, 2000). The new variety differs by the tubers white in transverse section, the verruculose bulblets, and the leaf texture membranaceous and thin papery.

Paratypes. CHINA. **Yunnan:** Mong-la, 4 Dec. 1959 (♂), *Ch. Q. Pei s.n.* (KUN 0241801); Mong-hain or Gan-lan-ba, Che-li Hsien, Oct. 1936 (♂), *C. W. Wang s.n.* (PE 00153582); Mong-la or Mong-pa, 19 Jan. 1964 (♀), *C. T. Ting, T. S. Wang & J. S. Yue 295b* (NAS 0422132); Meng-long, Yong-jing-

hong, 21 Dec. 1957, *C. T. Ting, T. S. Wang & J. S. Yue 0117* (NAS).

KEY TO THE VARIETIES OF *DIOSCOREA BULBIFERA* IN CHINA

1a. Tubers yellow in transverse section; bulblets globose or ovoid with orbicular spots; leaves chartaceous, not splitting when dry.
  2a. Leaves cordate or long cordate, base long cordate.
    3a. Male flowers with the sepals to 2–3 mm long . . . . . *D. bulbifera* var. *bulbifera*
    3b. Male flowers with the sepals to 4 mm long . . . . . *D. bulbifera* var. *simbha*
  2b. Leaves sagittate, base triangular-cordate when young . . . . . *D. bulbifera* var. *heterophylla*
1b. Tubers white in transverse section; bulblets irregular with verrucae; leaves widely ovate, deeply cordate at base, membranaceous, crispy when dry . . . . . *D. bulbifera* var. *albotuberosa*

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